TESTING LABORATORY
CERTIFICATE # 4821.01

FCC PART 15.247
TEST REPORT

For

Advanced Mobile Payment Inc.

Units 401-403, 15 Wertheim Court. Richmond Hill, Ontario L4B 3H7 Canada

FCC ID: 2AKJB-AMP6700

Report Type:	**Product Type:**
Original Report	AMP 6700

Report Number:	RSZ180809001-00B
Report Date:	2018-10-16
Reviewed By:	Simon Wang RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Advanced Mobile Payment Inc.'s* product, model number: *AMP 6700 (FCC ID: 2AKJB-AMP6700)* or the "EUT" in this report was a *AMP 6700,* which was measured approximately: 19.7 cm (L) * 19.2 cm (W) *4.4 cm (H), rated with input voltage: DC 9.5V from adapter.

Adapter Information:
Model: ADS-25SG-12-2 09524E
Input: AC 100-240V, 50/60Hz, Max. 0.7 A
Output: DC 9.5V, 2.5A

**All measurement and test data in this report was gathered from production sample serial number: 180809001. (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-08-09.*

Objective

This test report is prepared on behalf of *Advanced Mobile Payment Inc.* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15B JAB, Part 15.247 DTS and Part 15.225 DXX submissions with FCC ID: 2AKJB-AMP6700.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.5dB
RF conducted test with spectrum		±1.5dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±3℃
Humidity		±6%
Supply voltages		±0.4%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

EUT Exercise Software

Exercise Software "SecureCRT.exe" was used to the EUT tested and the power level is 9 (Specify Power Table index).

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Lenovo	Notebook	SR860	100000633225
Lenovo	Notebook	Air 15	100897564
Lenovo	Mouse	M300	11093844046
Philip	Earphone	SHE3705BK	28232617325
N/A	POE	PSE801FM	N/A

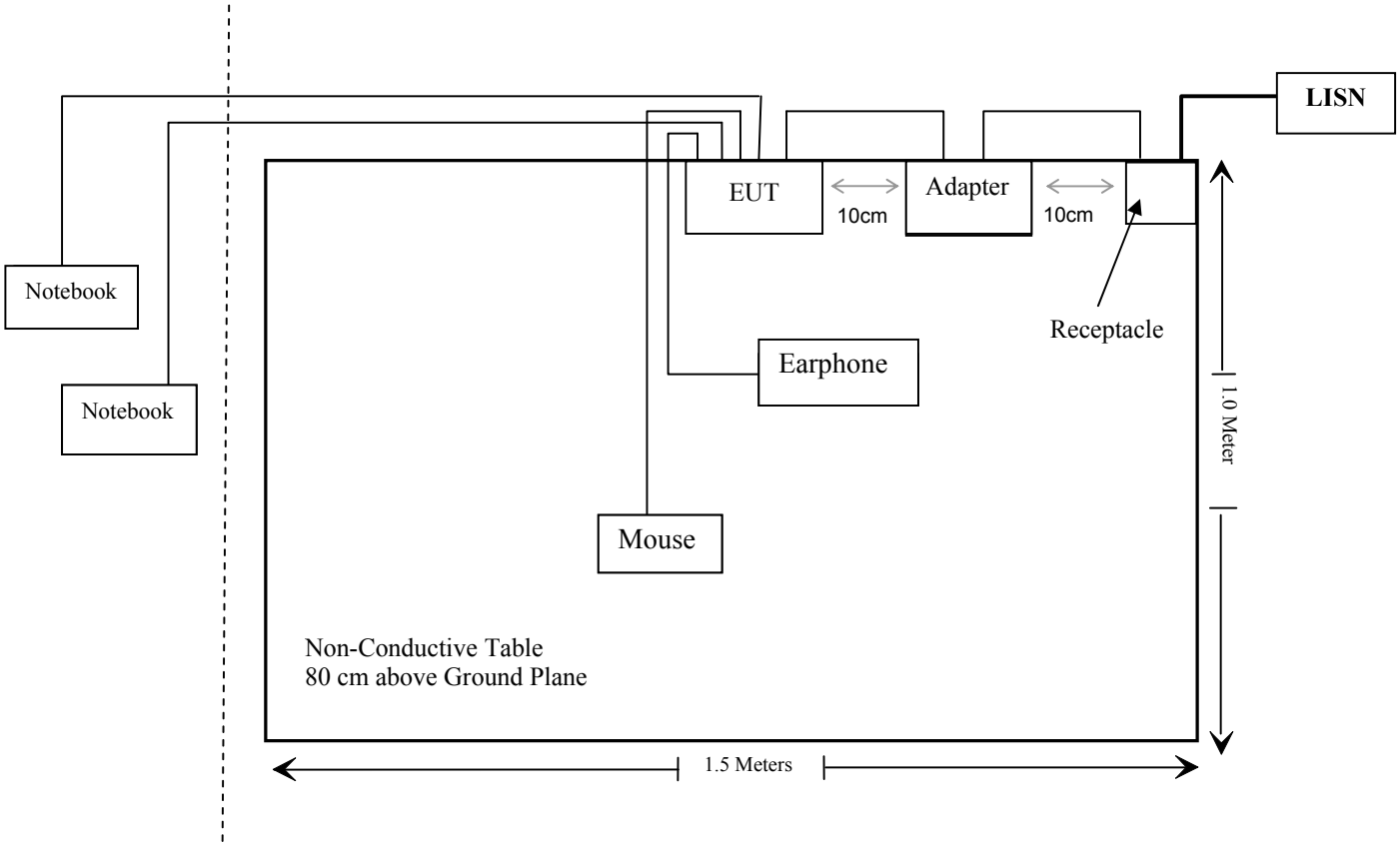
External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-Shielding Detachable DC Cable	1.2	EUT	Adapter
Un-shielding Detachable AC Cable	0.8	Adapter	Receptacle
Un-shielding Detachable Earphone Cable	0.8	EUT	Earphone
Un-shielding Undetachable AC Cable	1.0	Receptacle	LISN
Un-shielding Detachable RJ45 Cable	0.8	EUT	POE
Un-shielding Detachable AC Cable	1.0	POE	LISN

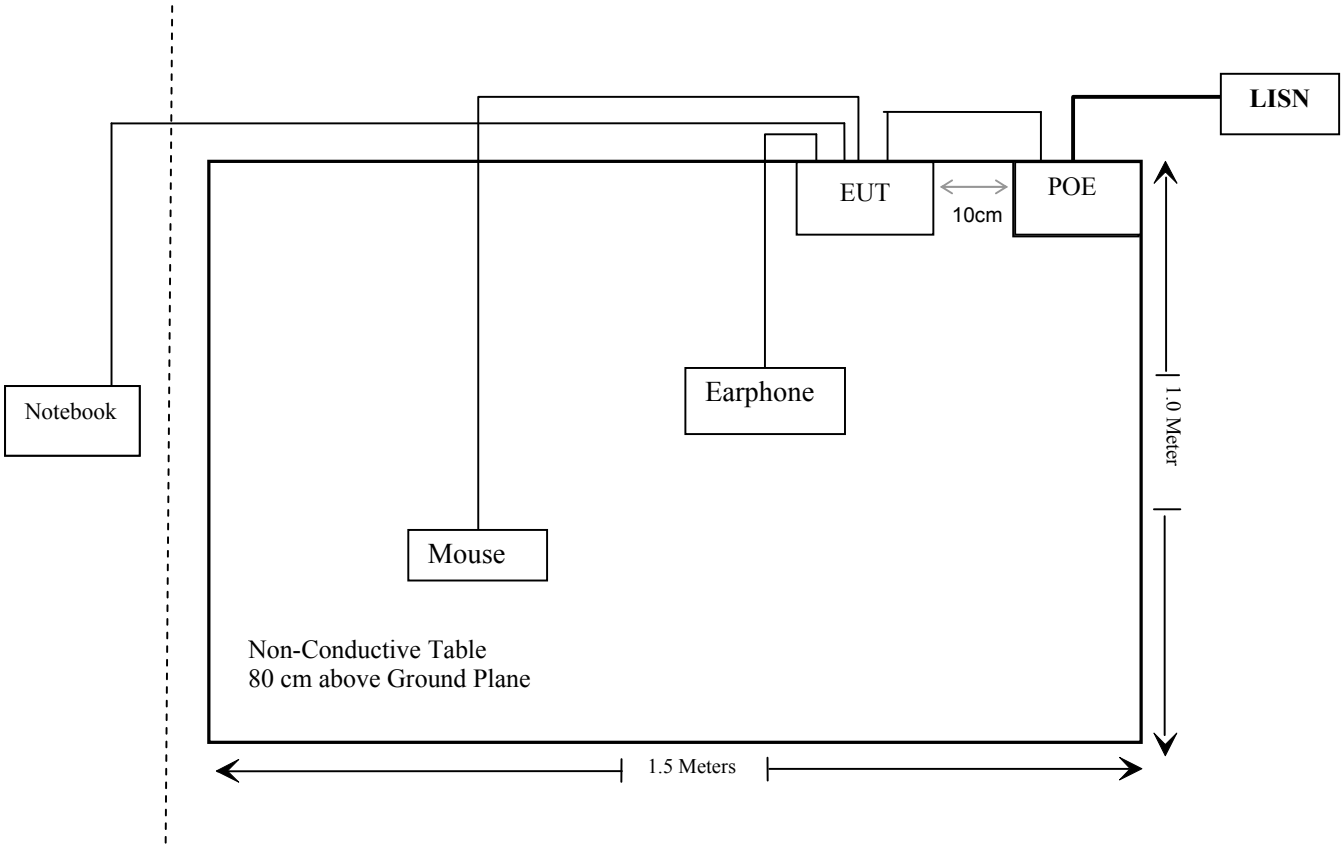
Block Diagram of Test Setup

Adapter power supply:

For conducted emission:



For POE Supply:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band edges	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2018-08-04	2019-08-04
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2017-12-21	2018-12-21
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2018-05-12	2018-11-21
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
/	Conducted Emission Cable	/	UF A210B-1-0720-504504	2018-05-12	2018-11-12
Radiated Emission Test					
A.H.System	Horn Antenna	SAS-200/571	135	2018-08-18	2021-08-17
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2018-06-23	2019-06-23
COM-POWER	Pre-amplifier	PA-122	181919	2018-05-22	2018-11-22
Sonoma instrument	Amplifier	310N	186238	2018-05-12	2018-11-12
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
Ducommun technologies	RF Cable	UFA147A-2362-100100	MFR64639 231029-003	2018-08-01	2019-02-01
Ducommun technologies	RF Cable	104PEA	218124002	2018-05-21	2018-11-21
Ducommun technologies	RF Cable	RG-214	1	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	RG-214	2	2018-05-22	2018-11-22
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-04	2017-12-29	2020-12-28
Heatsink Required	Amplifier	QLW-18405536-J0	15964001002	2018-08-01	2019-02-01
Sinoscite	Notch Filter	BSF2402-2480MN-0898-001	N/A	2018-05-21	2018-11-21
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Agilent	USB windebond power meter	U2021XA	MY54250003	2018-06-23	2019-06-23
WEINSCHEL	10dB Attenuator	5324	AU 3842	Each Time	
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2017-12-24	2018-12-24
Ducommun technologies	RF Cable	RG-214	3	Each Time	

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.247 (i) & §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Frequency (MHz)	Antenna Gain		Maximum Tune-up power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)			
BT	1.5	1.41	7.0	5.01	20	0.0014	1

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has one internal antenna arrangement, which was permanently attached and the antenna gain is 1.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

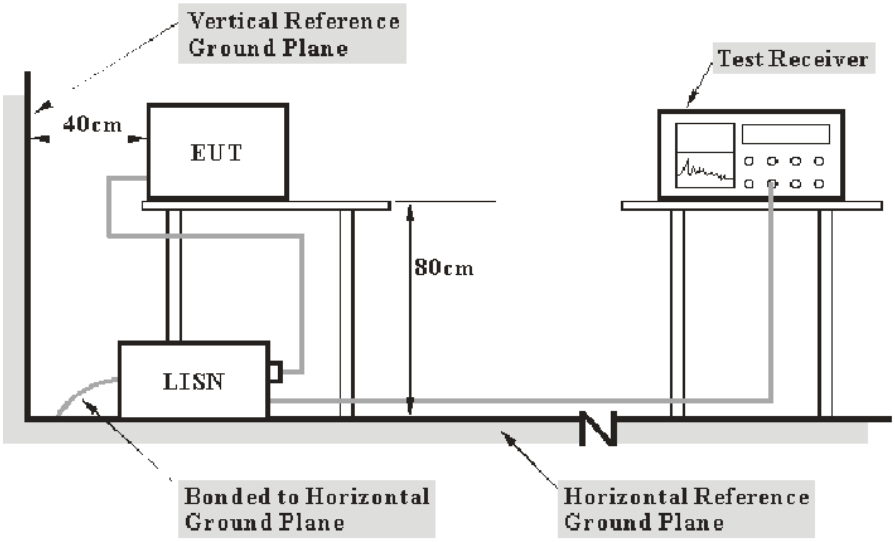
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207,

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

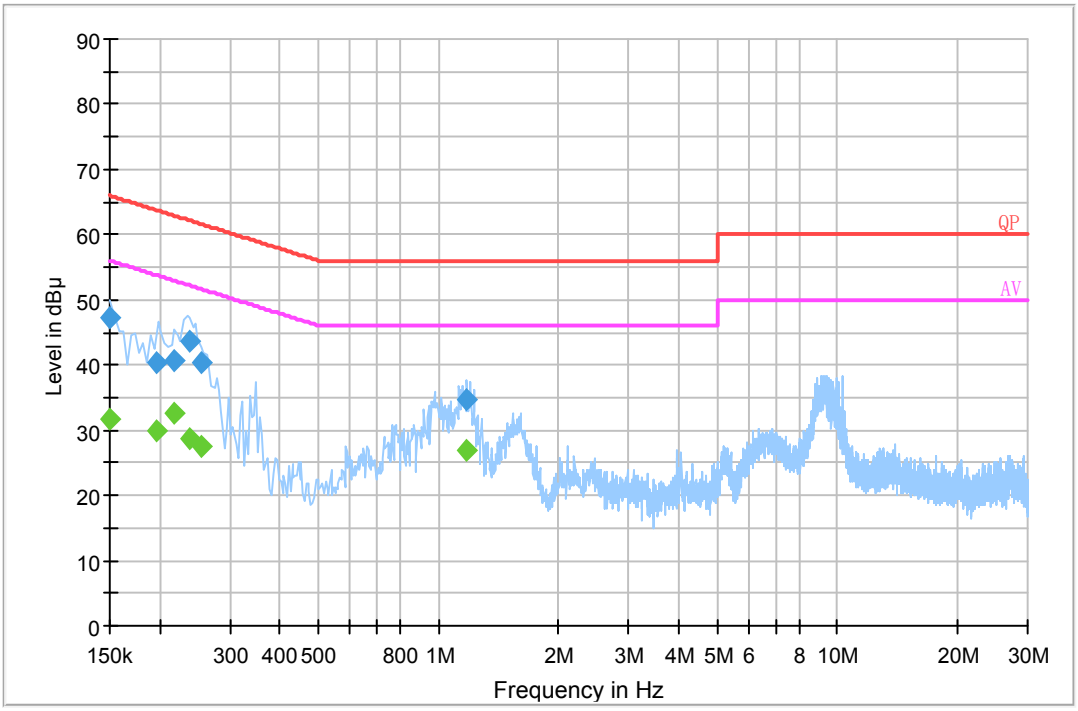
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Shawn Xiao on 2018-10-13.

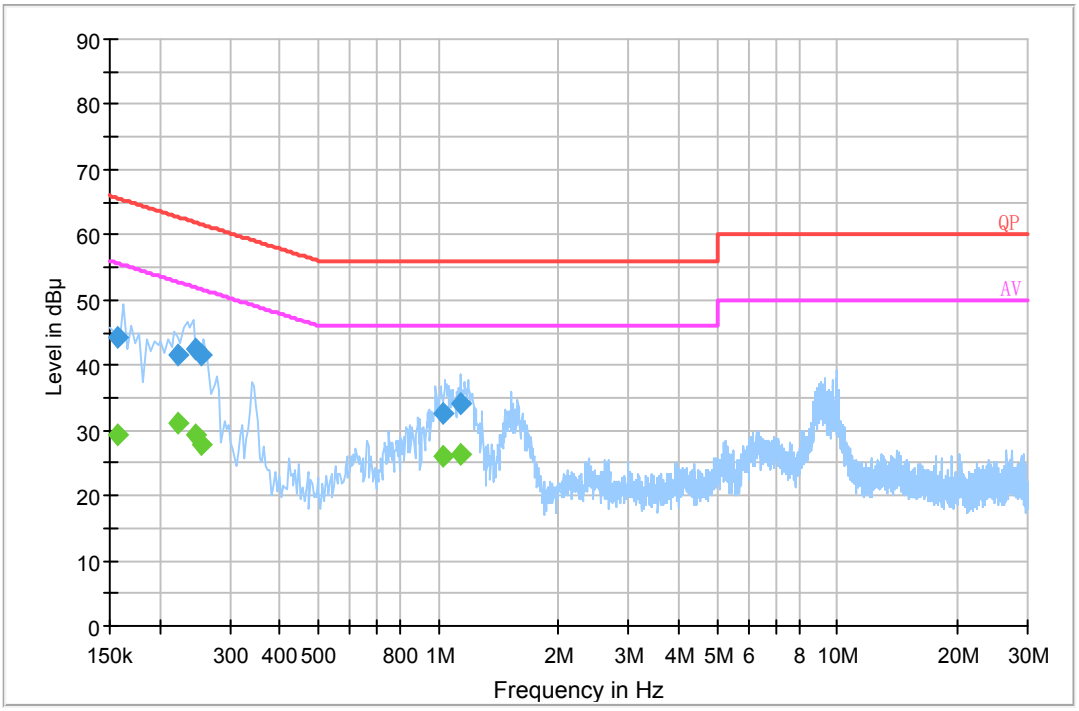
EUT operation mode: Transmitting & Charging (the worst case is GFSK Mode, Low channel)

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.150000	47.2	19.8	66.0	18.8	QP
0.197500	40.2	19.8	63.7	23.5	QP
0.217500	40.5	19.7	62.9	22.4	QP
0.238500	43.6	19.7	62.1	18.5	QP
0.253500	40.5	19.7	61.6	21.1	QP
1.176390	34.8	19.8	56.0	21.2	QP
0.150000	31.7	19.8	56.0	24.3	Ave.
0.197500	30.0	19.8	53.7	23.7	Ave.
0.217500	32.6	19.7	52.9	20.3	Ave.
0.238500	28.7	19.7	52.1	23.4	Ave.
0.253500	27.5	19.7	51.6	24.1	Ave.
1.176390	26.8	19.8	46.0	19.2	Ave.

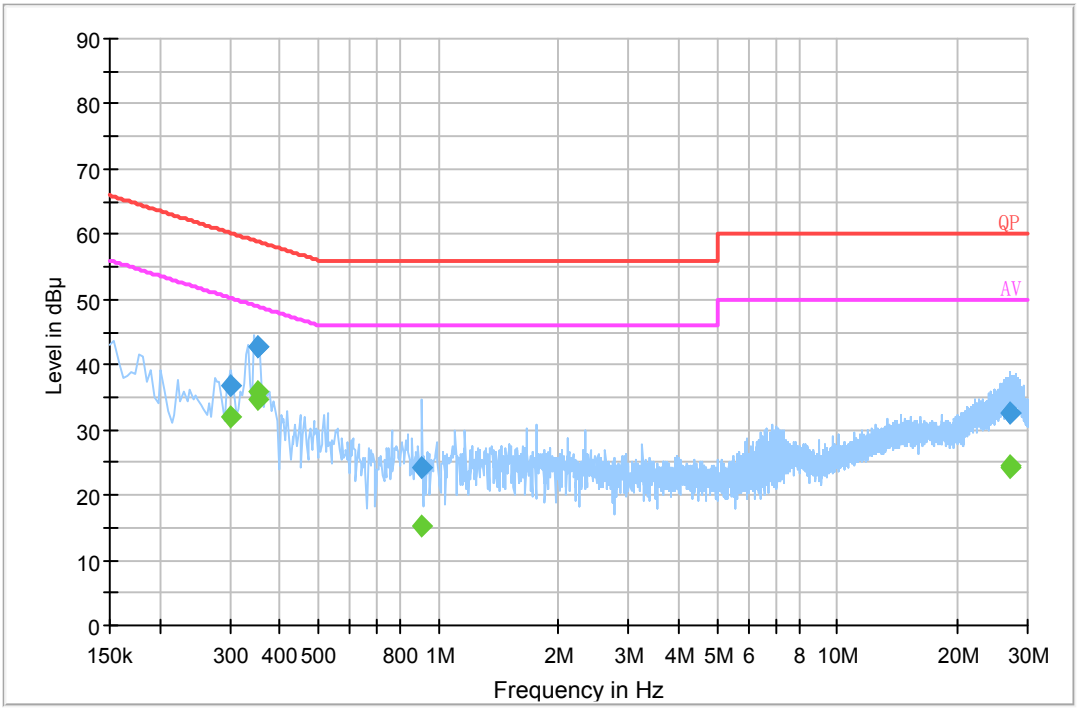
AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.157500	44.2	19.7	65.6	21.4	QP
0.221500	41.5	19.7	62.8	21.3	QP
0.246500	42.6	19.7	61.9	19.3	QP
0.253500	41.7	19.7	61.6	19.9	QP
1.022430	32.7	19.8	56.0	23.3	QP
1.140930	34.0	19.8	56.0	22.0	QP
0.157500	29.4	19.7	55.6	26.2	Ave.
0.221500	31.0	19.7	52.8	21.8	Ave.
0.246500	29.2	19.7	51.9	22.7	Ave.
0.253500	27.9	19.7	51.6	23.7	Ave.
1.022430	26.1	19.8	46.0	19.9	Ave.
1.140930	26.4	19.8	46.0	19.6	Ave.

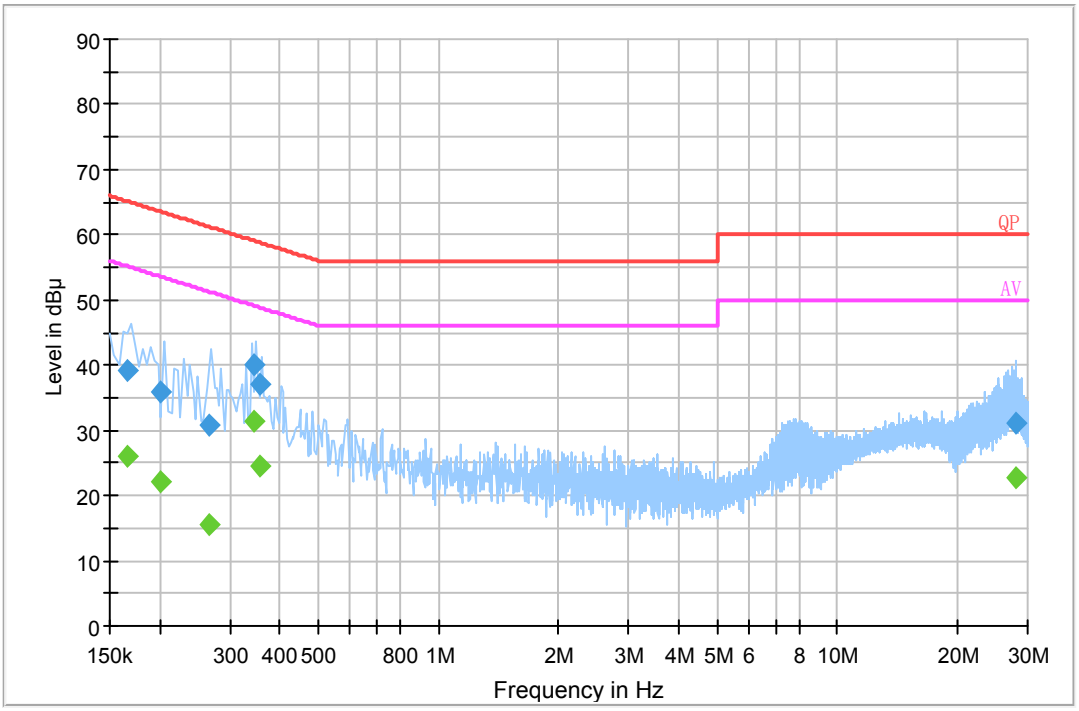
POE Supply:

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.301470	36.7	19.8	60.2	23.5	QP
0.351190	42.6	19.7	58.9	16.3	QP
0.352690	42.6	19.7	58.9	16.3	QP
0.904350	24.3	19.7	56.0	31.7	QP
27.077470	32.7	20.4	60.0	27.3	QP
27.165790	32.7	20.4	60.0	27.3	QP
0.301470	32.1	19.8	50.2	18.1	Ave.
0.351190	35.9	19.7	48.9	13.0	Ave.
0.352690	34.7	19.7	48.9	14.2	Ave.
0.904350	15.4	19.7	46.0	30.6	Ave.
27.077470	24.1	20.4	50.0	25.9	Ave.
27.165790	24.4	20.4	50.0	25.6	Ave.

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.165500	39.2	19.7	65.2	26.0	QP
0.201500	35.9	19.7	63.5	27.6	QP
0.265500	30.8	19.7	61.3	30.5	QP
0.344750	40.2	19.7	59.1	18.9	QP
0.356570	37.1	19.7	58.8	21.7	QP
28.107590	31.0	20.4	60.0	29.0	QP
0.165500	26.2	19.7	55.2	29.0	Ave.
0.201500	22.0	19.7	53.5	31.5	Ave.
0.265500	15.4	19.7	51.3	35.9	Ave.
0.344750	31.4	19.7	49.1	17.7	Ave.
0.356570	24.7	19.7	48.8	24.1	Ave.
28.107590	22.8	20.4	50.0	27.2	Ave.

Note:
1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

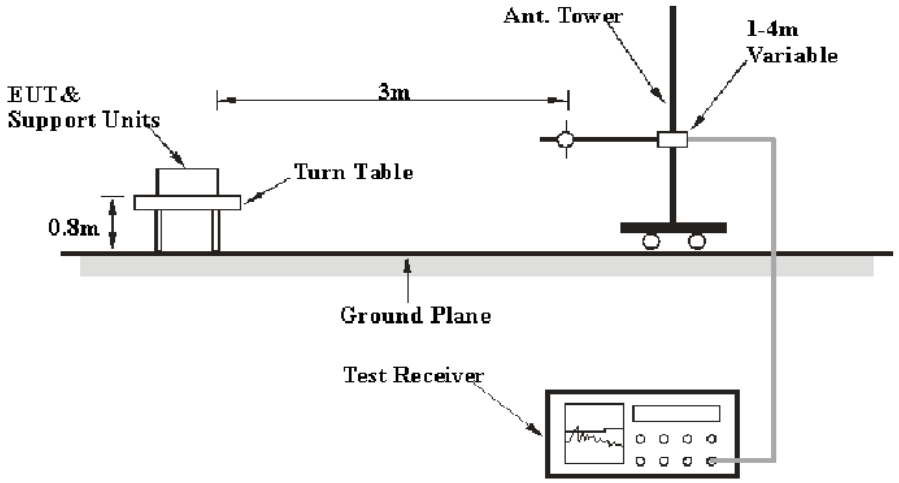
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

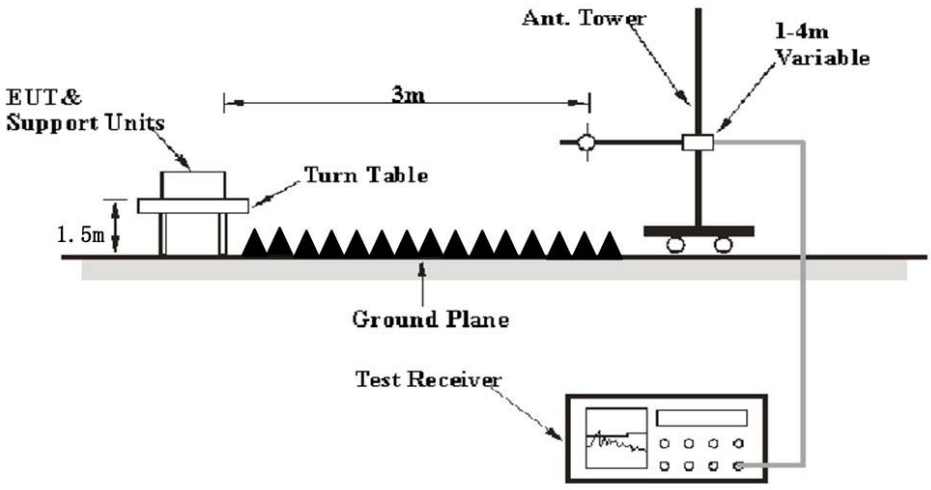
FCC §15.205; §15.209; §15.247(d)

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Average

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

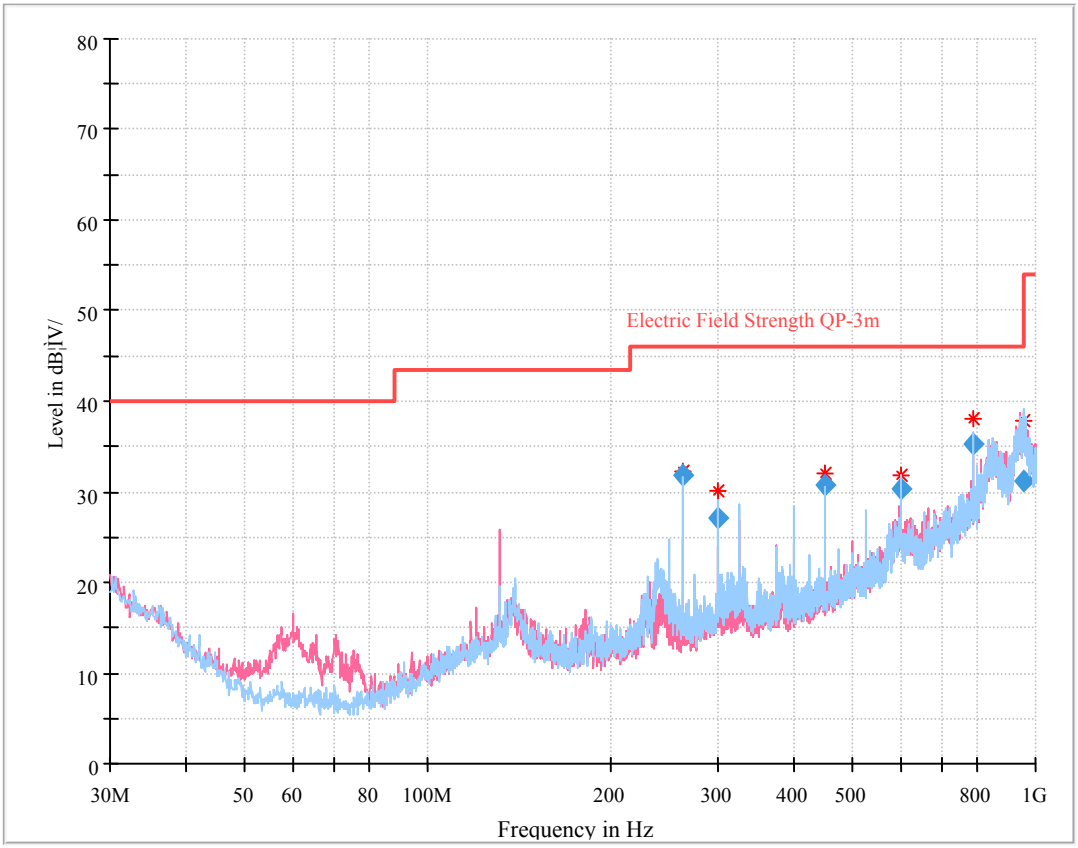
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Shawn Xiao on 2018-09-25.

EUT operation mode: Transmitting (*Scan with GFSK, π/4-DQPSK, 8-DPSK mode, the worst case is GFSK Mode*)

30 MHz~1 GHz: *(the worst case is GFSK Mode, Low channel)*



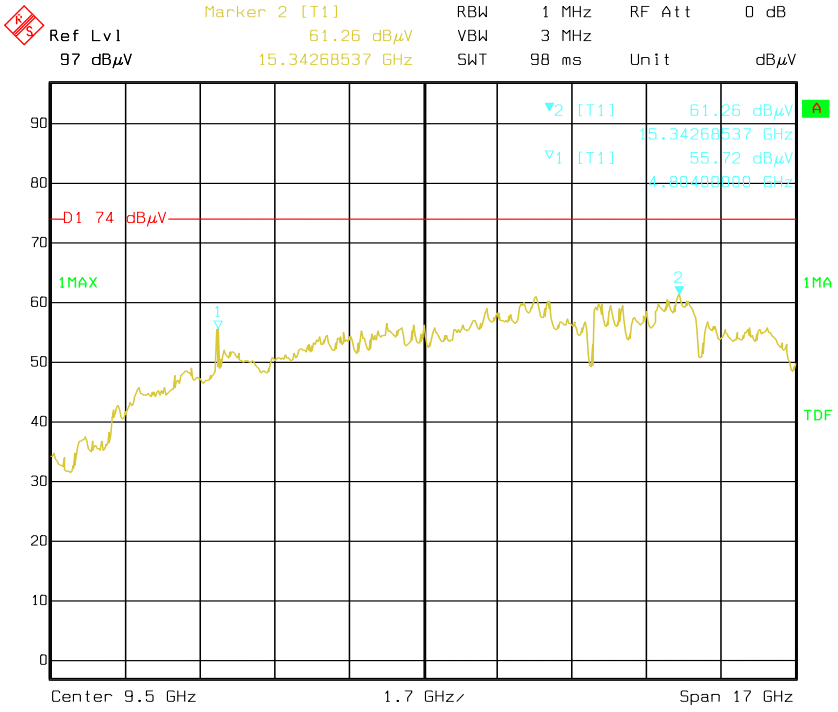
Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
262.489250	31.79	124.0	H	37.0	-13.2	46.00	14.21
299.994250	27.20	113.0	H	108.0	-10.6	46.00	18.80
450.005750	30.86	108.0	H	225.0	-8.2	46.00	15.14
600.015250	30.35	110.0	H	260.0	-1.6	46.00	15.65
787.517250	35.27	108.0	H	16.0	1.3	46.00	10.73
954.758875	31.25	380.0	H	58.0	9.6	46.00	14.75

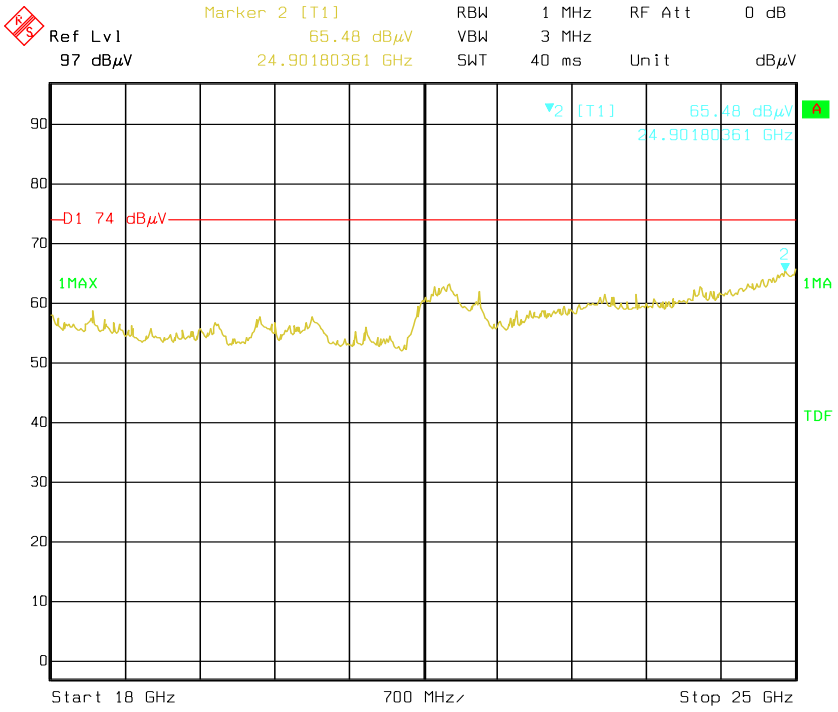
1 GHz - 25 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2402 MHz)									
2402.00	70.83	PK	181	2.5	H	33.00	103.83	/	/
2402.00	59.10	Ave.	181	2.5	H	33.00	92.10	/	/
2402.00	61.49	PK	229	1.8	V	33.00	94.49	/	/
2402.00	49.87	Ave.	229	1.8	V	33.00	82.87	/	/
2390.00	27.39	PK	99	1.6	H	33.00	60.39	74	13.61
2390.00	13.47	Ave.	99	1.6	H	33.00	46.47	54	7.53
2483.50	27.05	PK	82	2.4	H	33.20	60.25	74	13.75
2483.50	13.26	Ave.	82	2.4	H	33.20	46.46	54	7.54
4804.00	48.34	PK	150	1.5	H	7.88	56.22	74	17.78
4804.00	40.68	Ave.	150	1.7	H	7.88	48.56	54	5.44
Middle Channel (2441 MHz)									
2441.00	70.50	PK	271	1.5	H	33.10	103.60	/	/
2441.00	58.89	Ave.	271	1.5	H	33.10	91.99	/	/
2441.00	61.72	PK	108	2.2	V	33.10	94.82	/	/
2441.00	49.92	Ave.	108	2.2	V	33.10	83.02	/	/
4882.00	46.38	PK	337	2.0	H	9.21	55.59	74	18.41
4882.00	38.75	Ave.	337	2.0	H	9.21	47.96	54	6.04
High Channel (2480 MHz)									
2480.00	70.44	PK	246	2.1	H	33.20	103.64	/	/
2480.00	58.35	Ave.	246	2.1	H	33.20	91.55	/	/
2480.00	61.30	PK	93	1.8	V	33.20	94.50	/	/
2480.00	49.52	Ave.	93	1.8	V	33.20	82.72	/	/
2390.00	27.16	PK	282	1.2	H	33.00	60.16	74	13.84
2390.00	13.34	Ave.	282	1.2	H	33.00	46.34	54	7.66
2483.50	30.43	PK	285	1.4	H	33.20	63.63	74	10.37
2483.50	18.23	Ave.	285	1.4	H	33.20	51.43	54	2.57
4960.00	46.77	PK	51	2.4	H	9.07	55.84	74	18.16
4960.00	36.88	Ave.	51	2.4	H	9.07	45.95	54	8.05

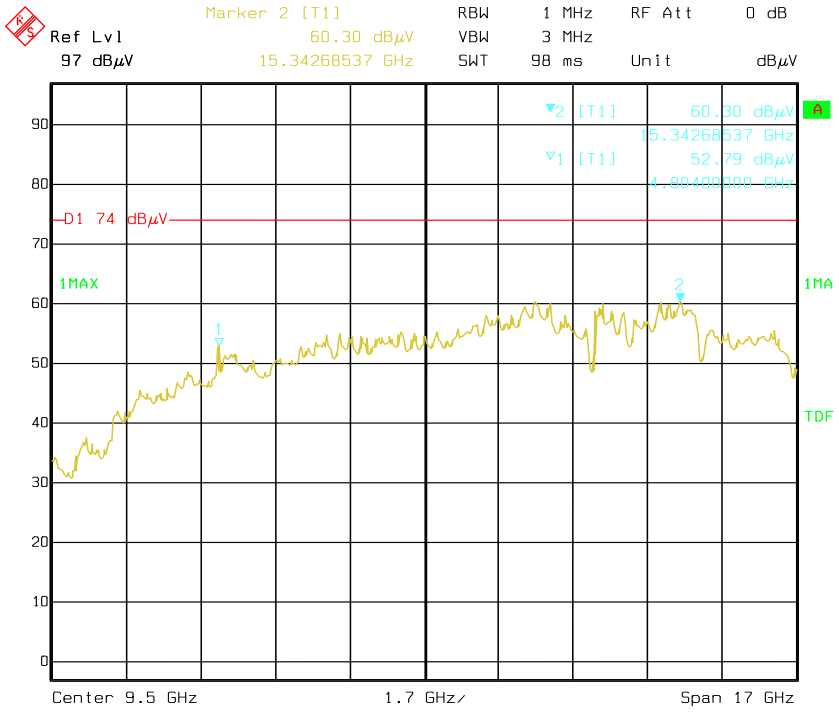
Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.
And for the pre-scan is performed with the 2400-2483.5MHz band filter.

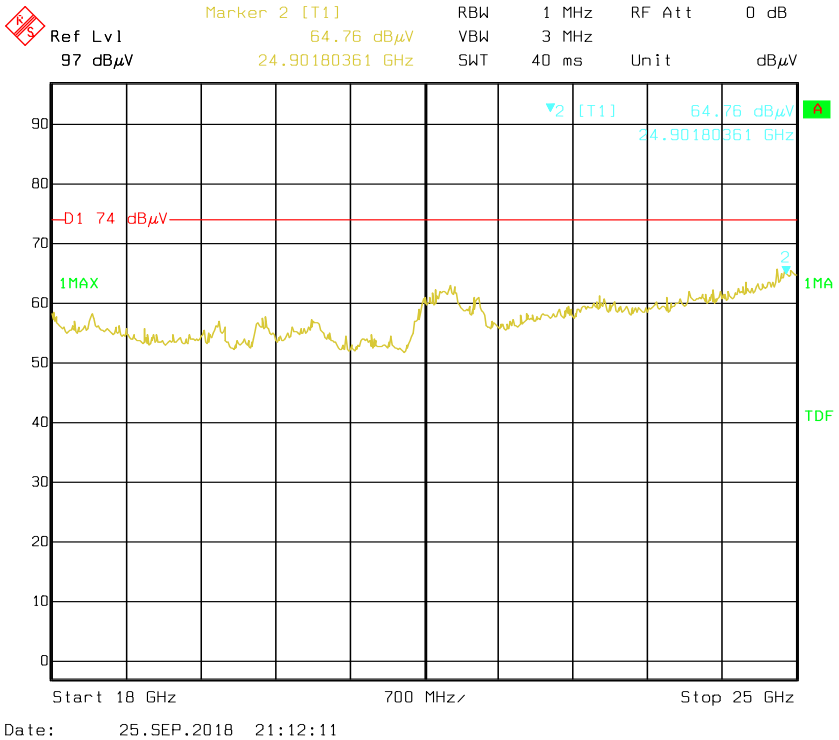
Pre-scan with Low channel Peak
Horizontal



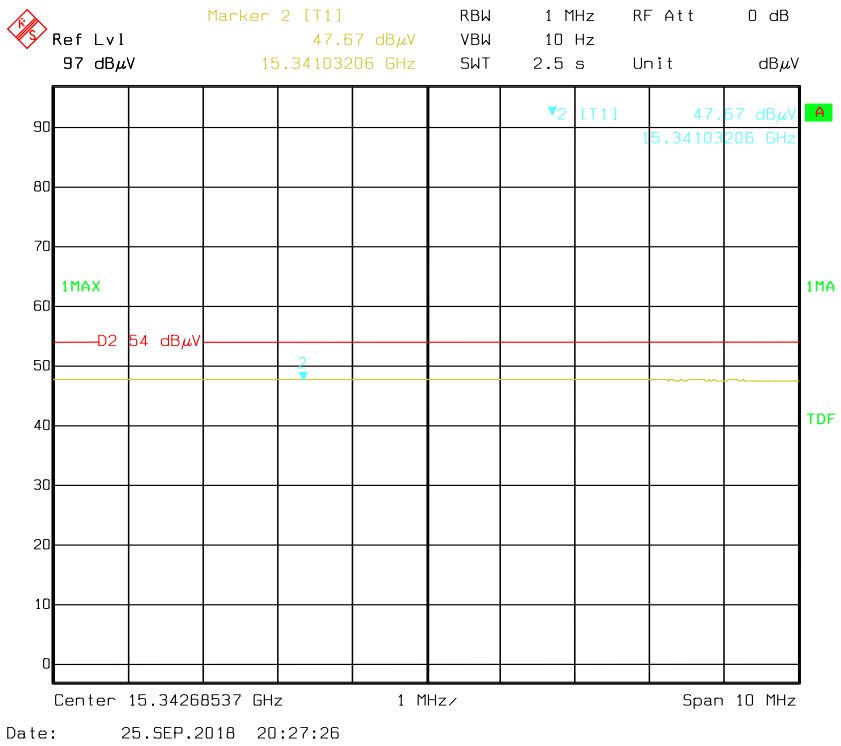


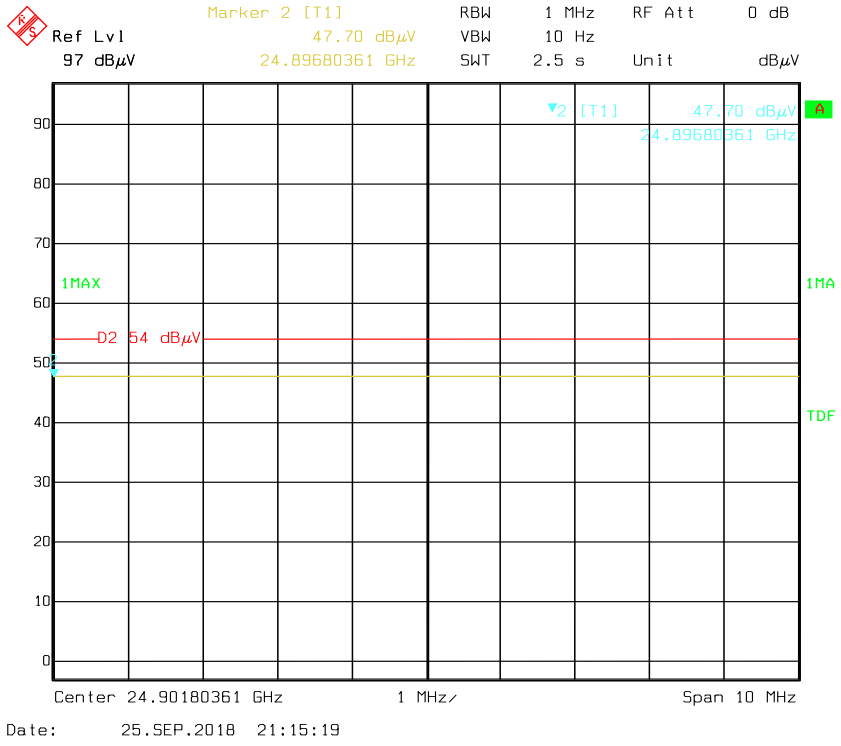
Vertical

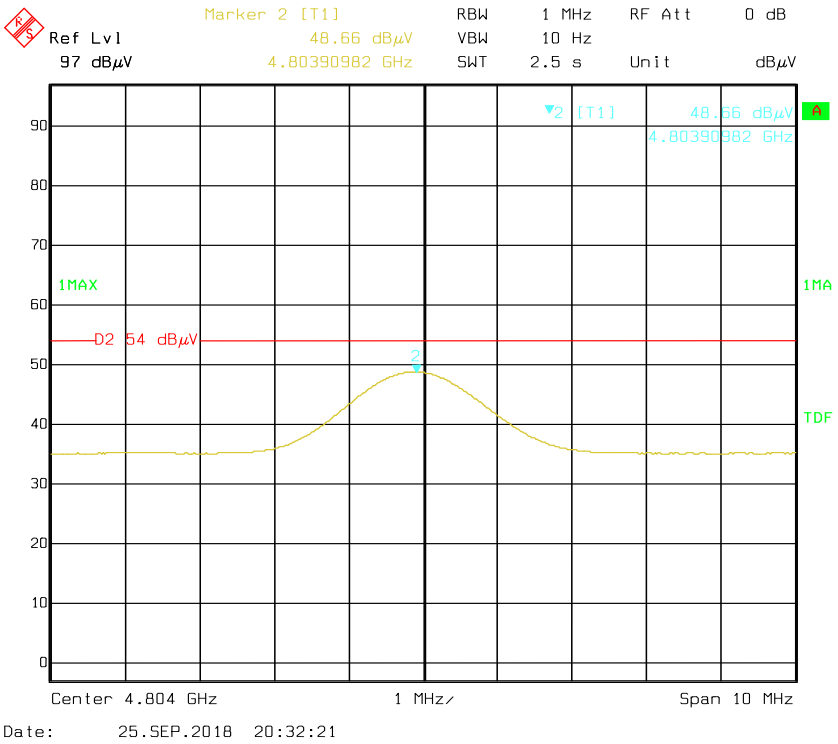

Marker 2 [T1]
Ref Lvl
97 dBµV
60.30 dBµV
15.34268537 GHz
RBW 1 MHz
VBW 3 MHz
SWT 98 ms
RF Att 0 dB
Unit dBµV
▼2 [T1] 60.30 dBµV
15.34268537 GHz
▽1 [T1] 52.79 dBµV
4.80400300 GHz
D1 74 dBµV
1MAX
1MA
TDF
A
Center 9.5 GHz
1.7 GHz/
Span 17 GHz
Date: 25.SEP.2018 20:24:09


Marker 2 [T1]
Ref Lvl
97 dBµV
64.76 dBµV
24.90180361 GHz
RBW 1 MHz
VBW 3 MHz
SWT 40 ms
RF Att 0 dB
Unit dBµV
▼2 [T1] 64.76 dBµV
24.90180361 GHz
D1 74 dBµV
1MAX
1MA
TDF
A
Start 18 GHz
700 MHz/
Stop 25 GHz
Date: 25.SEP.2018 21:12:11

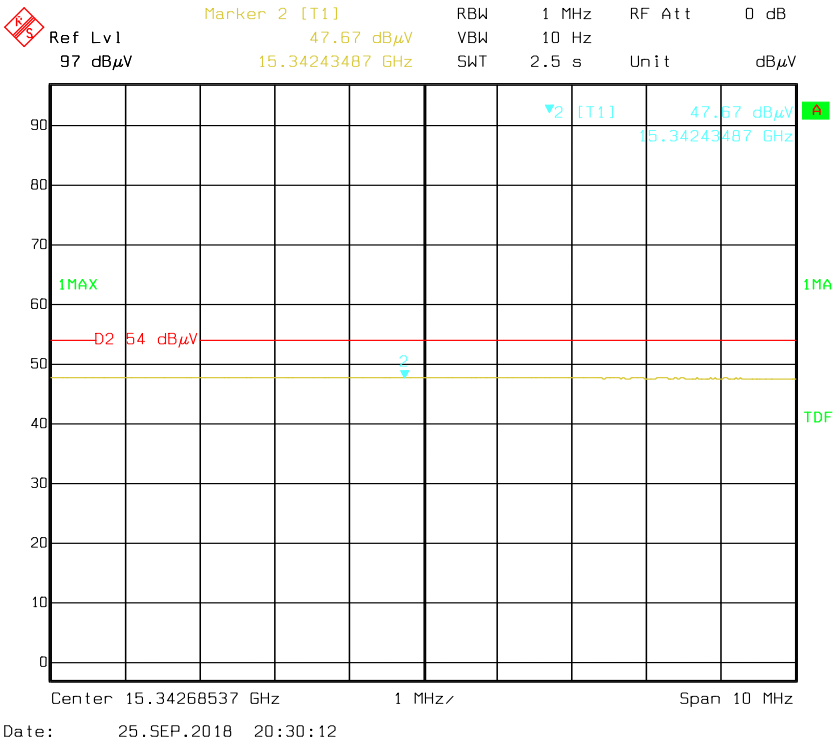
Pre-scan for Average
Horizontal

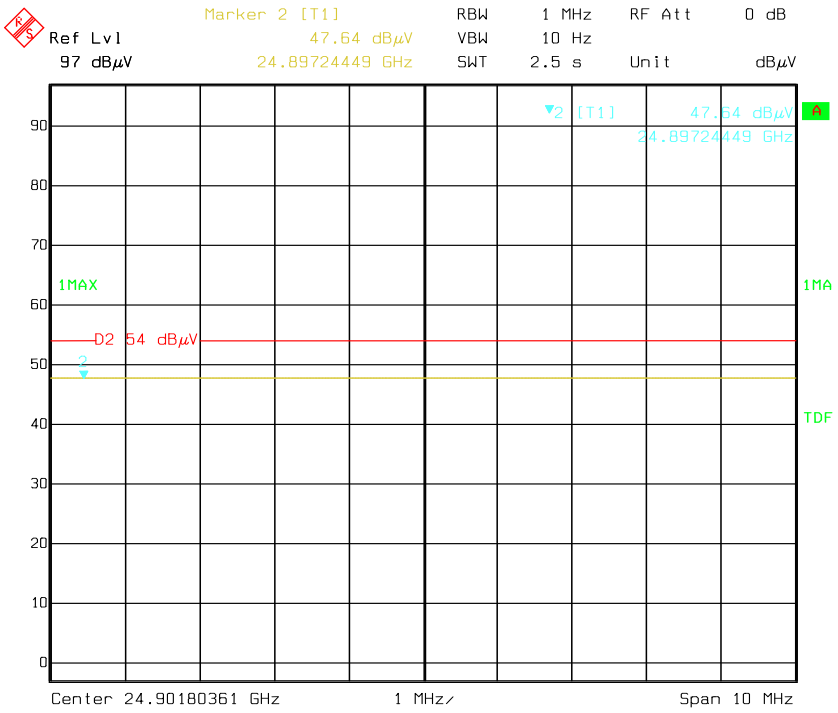


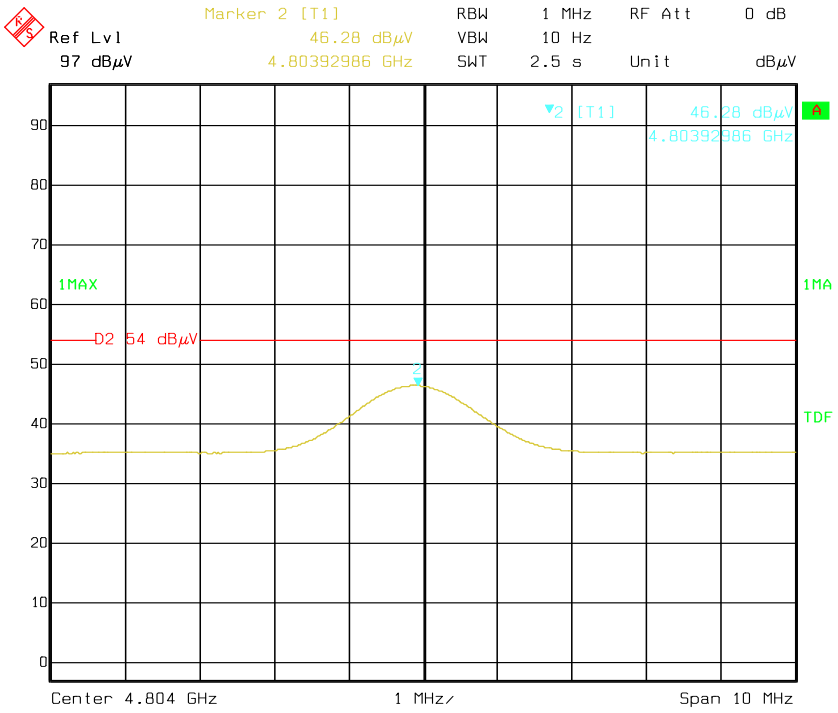



Marker 2 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl
48.66 dBµV
VBW 10 Hz
97 dBµV
4.80390982 GHz
SWT 2.5 s
Unit dBµV
2 [T1] 48.66 dBµV
4.80390982 GHz
1MAX
1MA
D2 54 dBµV
TDF
Center 4.804 GHz
1 MHz/
Span 10 MHz
Date: 25.SEP.2018 20:32:21

Vertical


Marker 2 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl
47.67 dBµV
VBW 10 Hz
97 dBµV
15.34243487 GHz
SWT 2.5 s
Unit dBµV
2 [T1] 47.67 dBµV
15.34243487 GHz
1MAX
1MA
D2 54 dBµV
TDF
Center 15.34268537 GHz
1 MHz/
Span 10 MHz
Date: 25.SEP.2018 20:30:12


Marker 2 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl
47.64 dBµV
VBW 10 Hz
97 dBµV
24.89724449 GHz
SWT 2.5 s
Unit dBµV
2 [T1] 47.64 dBµV
24.89724449 GHz
A
1MAX
1MA
D2 54 dBµV
TDF
Center 24.90180361 GHz
1 MHz/
Span 10 MHz
Date: 25.SEP.2018 21:18:13


Marker 2 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl
46.28 dBµV
VBW 10 Hz
97 dBµV
4.80392986 GHz
SWT 2.5 s
Unit dBµV
2 [T1] 46.28 dBµV
4.80392986 GHz
A
1MAX
1MA
D2 54 dBµV
TDF
Center 4.804 GHz
1 MHz/
Span 10 MHz
Date: 25.SEP.2018 20:35:07

FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

Applicable Standard

Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Procedure

1. Set the EUT in transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Shawn Xiao on 2018-09-13.

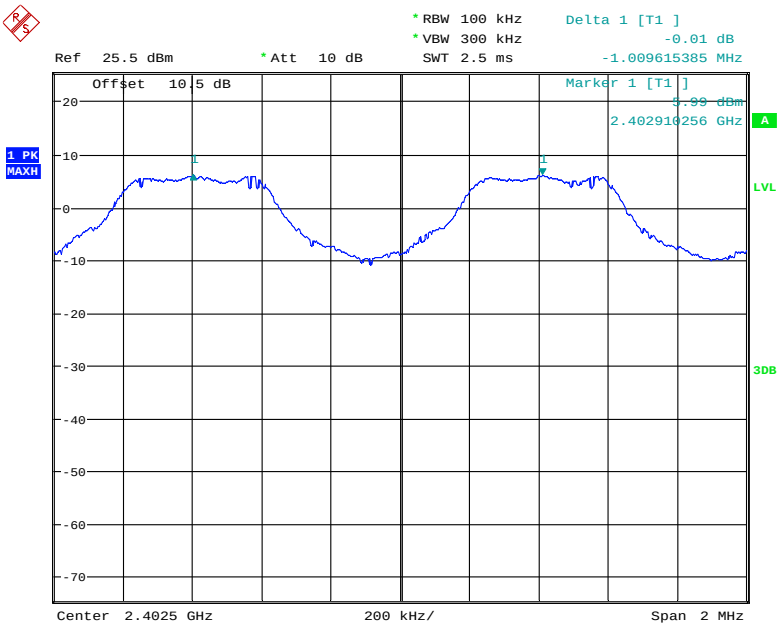
EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following table and plots.

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	≥Limit (MHz)	Result
BDR (GFSK)	Low	2402	1.010	0.789	Pass
	Adjacent	2403			
	Middle	2441	1.000	0.692	Pass
	Adjacent	2442			
	High	2480	1.000	0.692	Pass
	Adjacent	2479			
EDR (π/4-DQPSK)	Low	2402	1.000	0.894	Pass
	Adjacent	2403			
	Middle	2441	1.003	0.894	Pass
	Adjacent	2442			
	High	2480	0.997	0.897	Pass
	Adjacent	2479			
EDR (8-DPSK)	Low	2402	1.000	0.862	Pass
	Adjacent	2403			
	Middle	2441	1.000	0.856	Pass
	Adjacent	2442			
	High	2480	1.003	0.856	Pass
	Adjacent	2479			

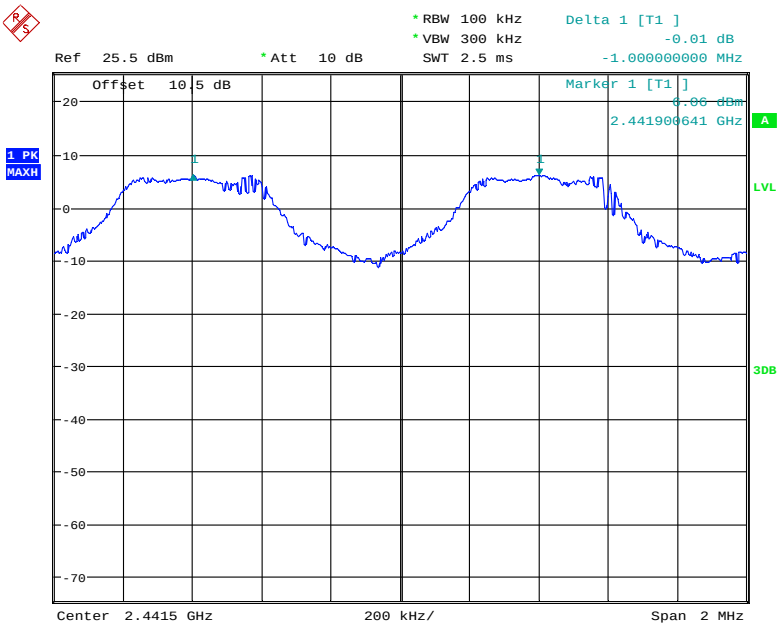
Note: Limit = 20 dB bandwidth *2/3

BDR (GFSK): Low Channel



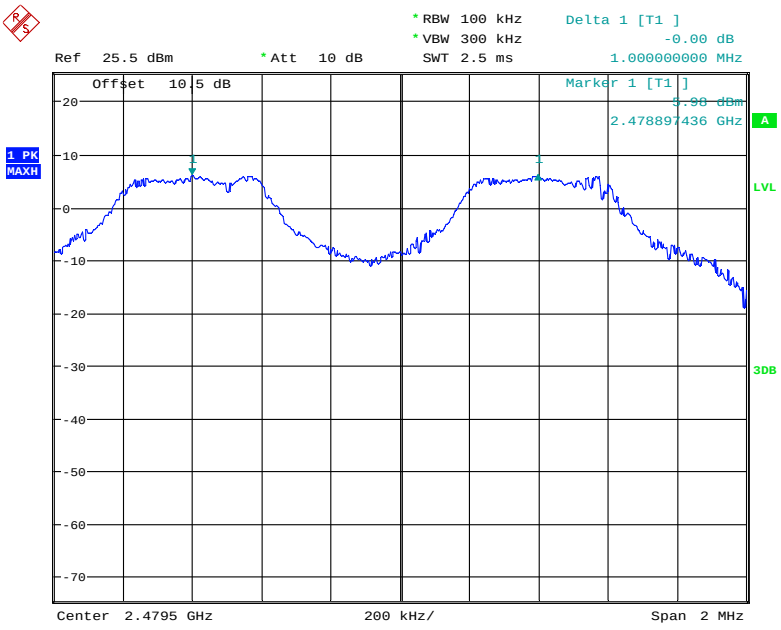
Date: 13.SEP.2018 21:40:25

BDR (GFSK): Middle Channel



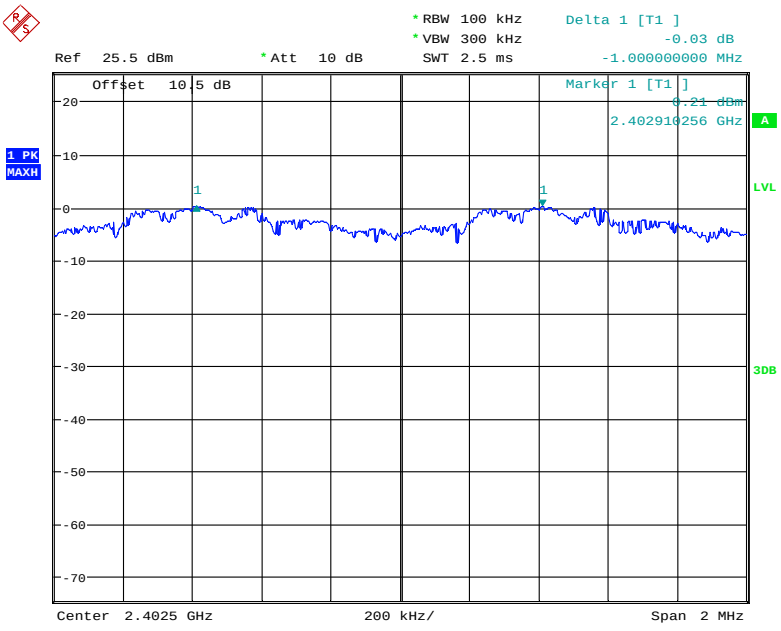
Date: 13.SEP.2018 21:42:39

BDR (GFSK): High Channel



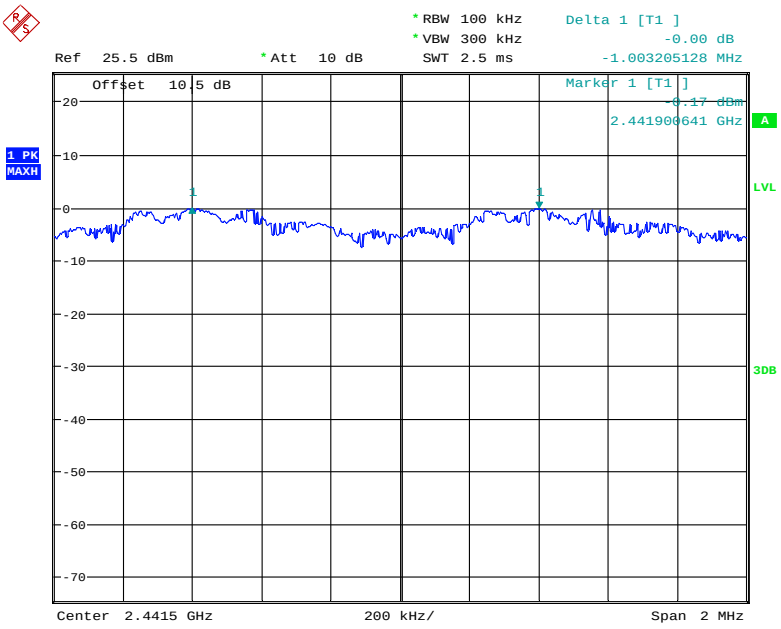
Date: 13.SEP.2018 21:44:15

EDR (π/4-DQPSK): Low Channel



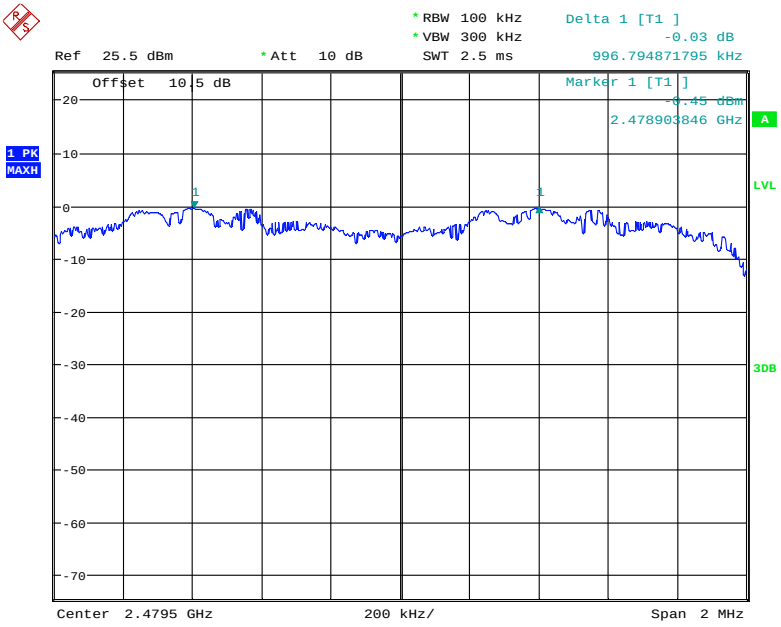
Date: 13.SEP.2018 21:48:29

EDR (π/4-DQPSK): Middle Channel



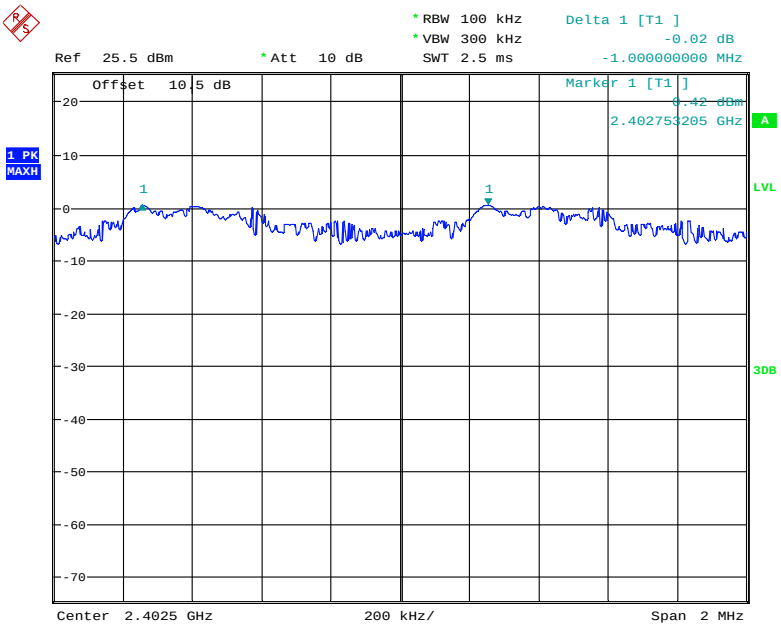
Date: 13.SEP.2018 21:51:01

EDR (π/4-DQPSK): High Channel



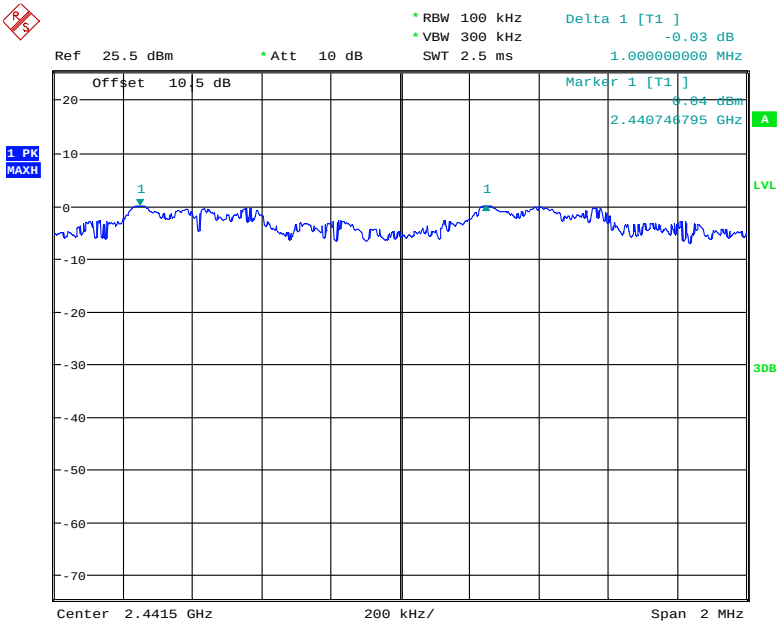
Date: 13.SEP.2018 21:53:25

EDR (8-DPSK): Low Channel



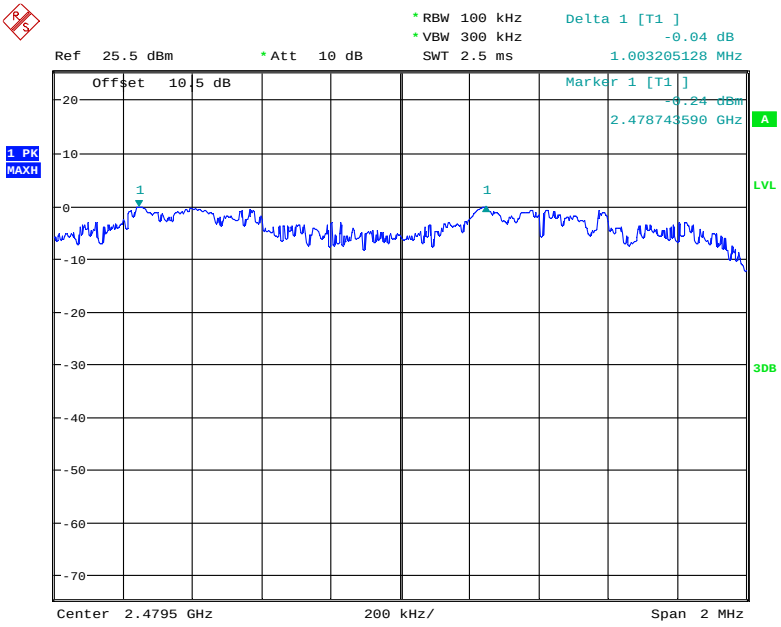
Date: 13.SEP.2018 21:56:00

EDR (8-DPSK): Middle Channel



Date: 13.SEP.2018 21:58:27

EDR (8-DPSK): High Channel



Date: 13.SEP.2018 22:00:36

FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH

Applicable Standard

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

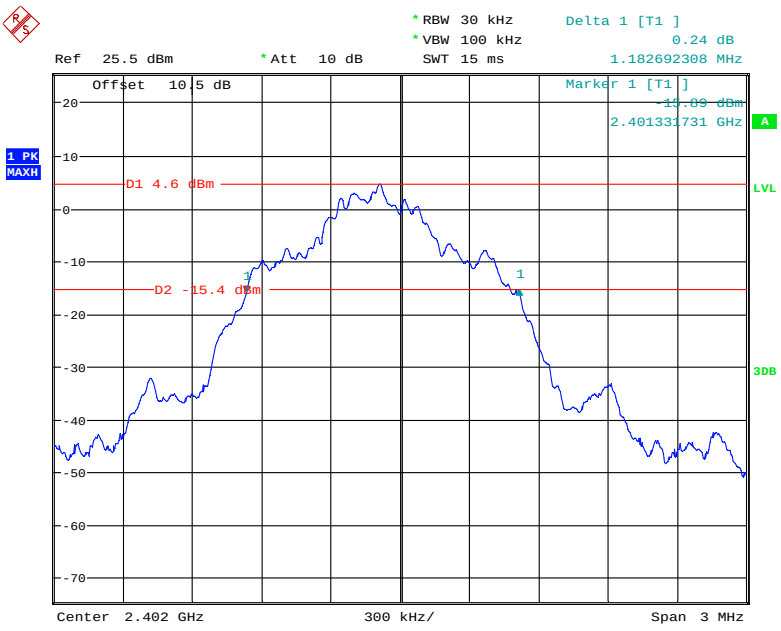
The testing was performed by Shawn Xiao on 2018-09-13.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following table and plots.

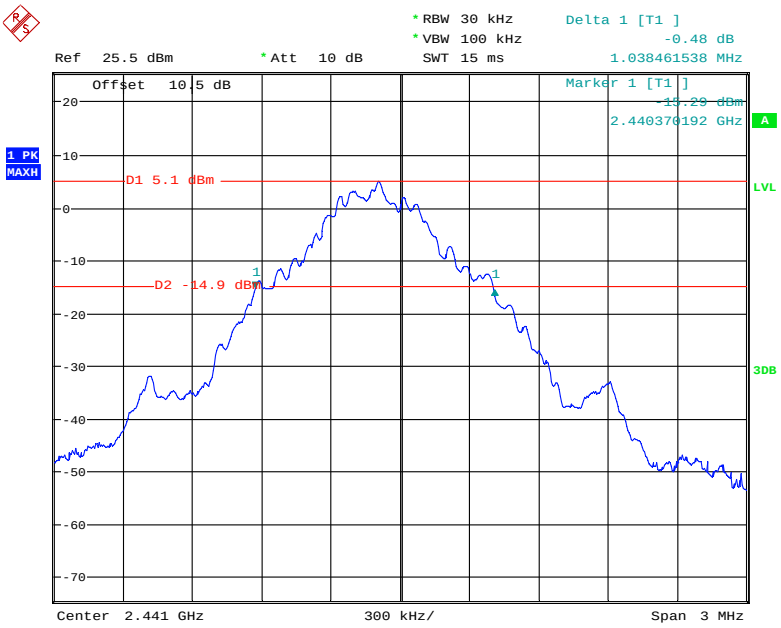
Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	1.183
	Middle	2441	1.038
	High	2480	1.038
EDR (π/4-DQPSK)	Low	2402	1.341
	Middle	2441	1.341
	High	2480	1.346
EDR (8-DPSK)	Low	2402	1.293
	Middle	2441	1.284
	High	2480	1.284

BDR (GFSK): Low Channel



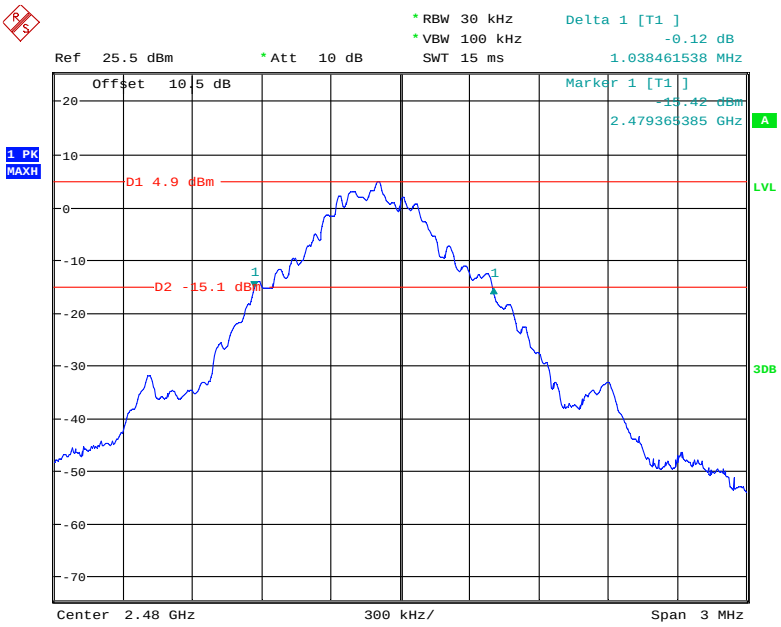
Date: 13.SEP.2018 21:19:38

BDR (GFSK): Middle Channel



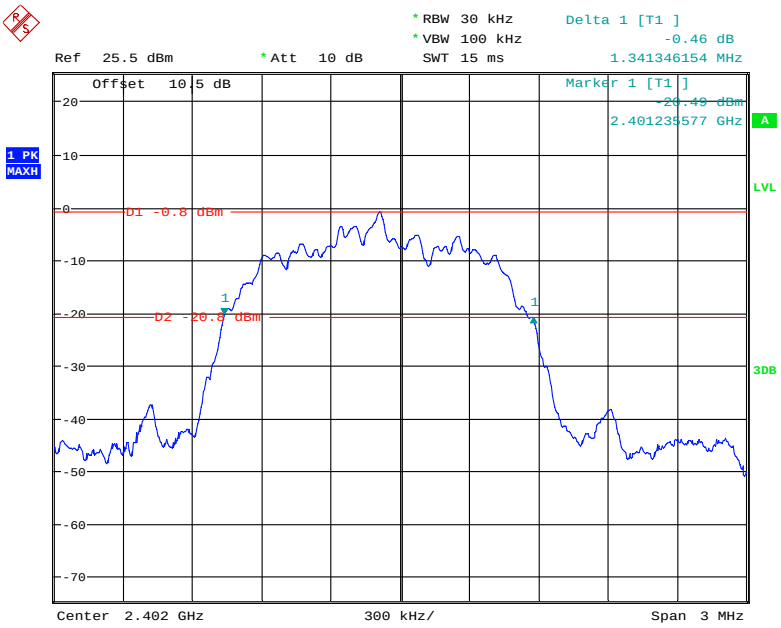
Date: 13.SEP.2018 21:26:37

BDR (GFSK): High Channel



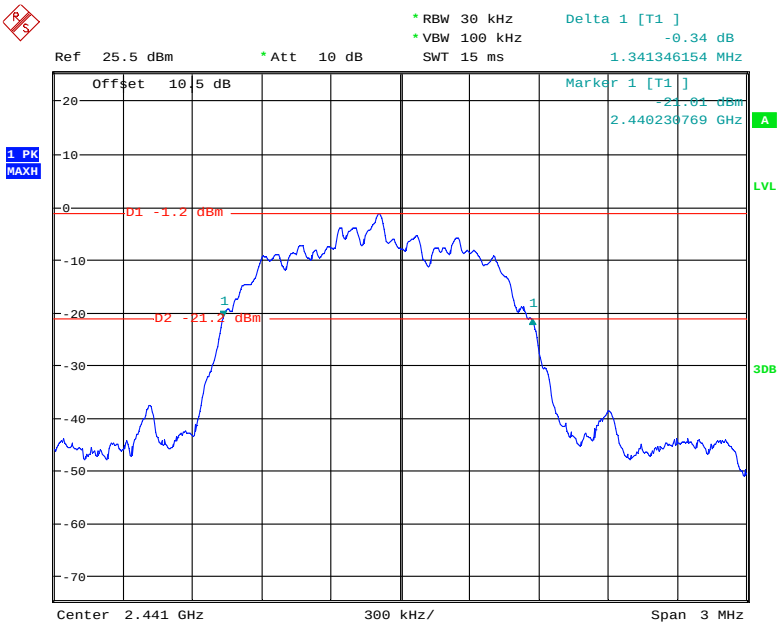
Date: 13.SEP.2018 21:27:56

EDR (π/4-DQPSK): Low Channel



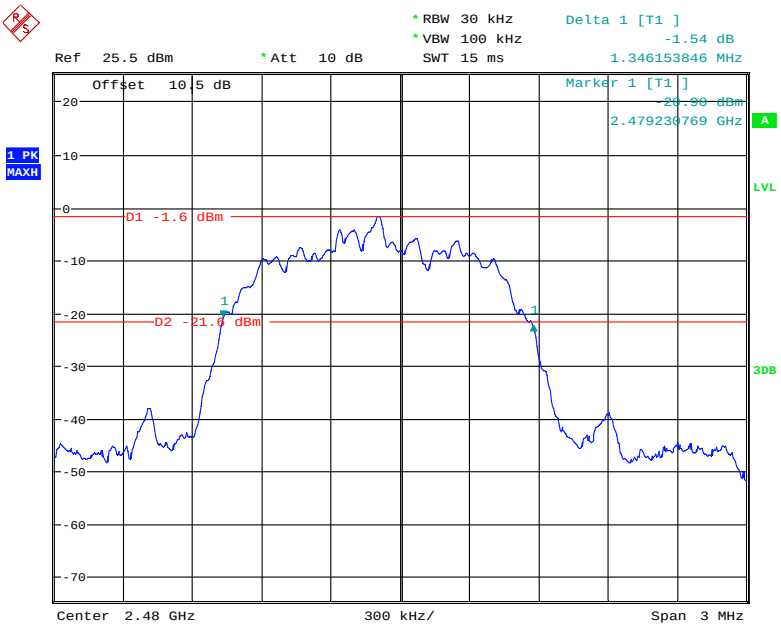
Date: 13.SEP.2018 21:29:10

EDR (π/4-DQPSK): Middle Channel



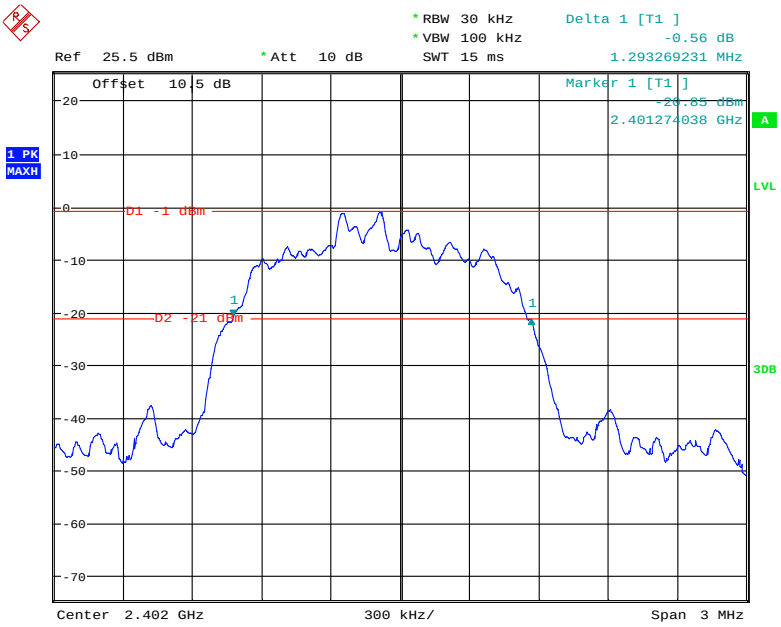
Date: 13.SEP.2018 21:30:21

EDR (π/4-DQPSK): High Channel



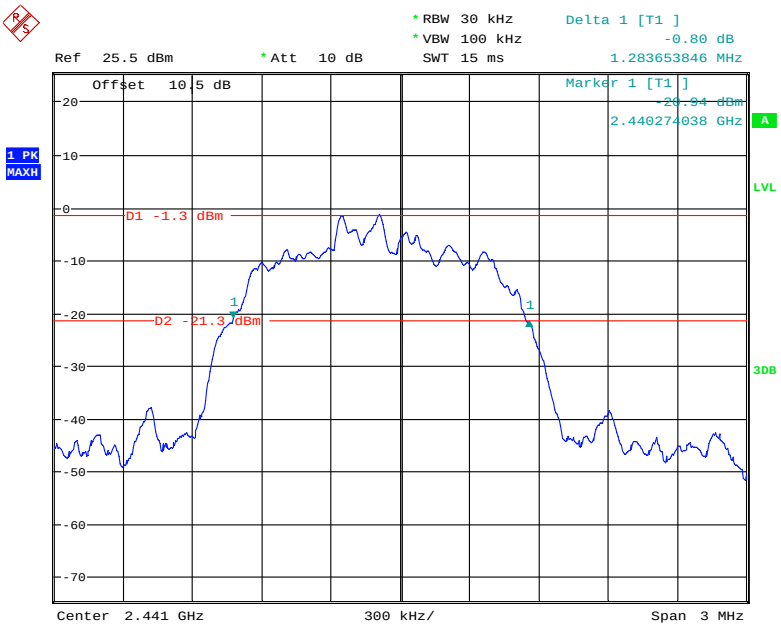
Date: 13.SEP.2018 21:31:12

EDR (8-DPSK): Low Channel



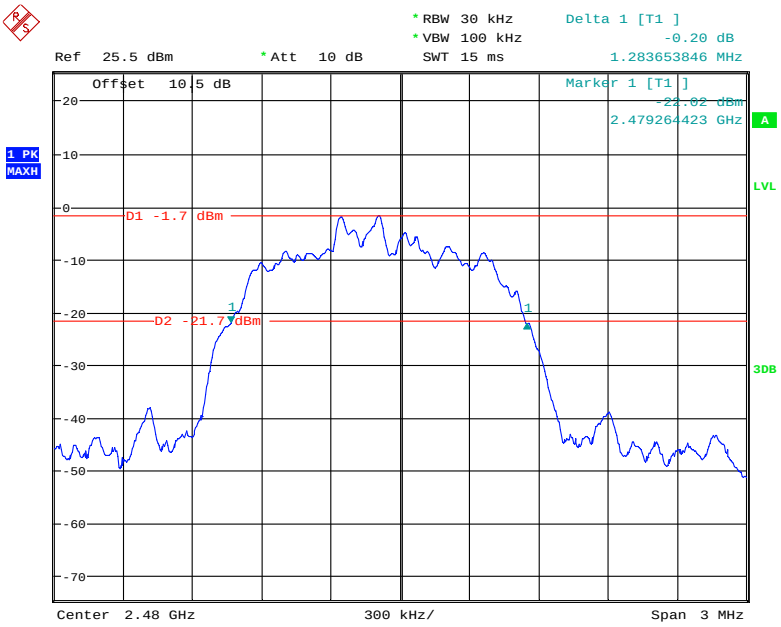
Date: 13.SEP.2018 21:32:21

EDR (8-DPSK): Middle Channel



Date: 13.SEP.2018 21:33:24

EDR (8-DPSK): High Channel



Date: 13.SEP.2018 21:34:29

FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Set the EUT in hopping mode from first channel to last.

3. By using the max-hold function record the quantity of the channel.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

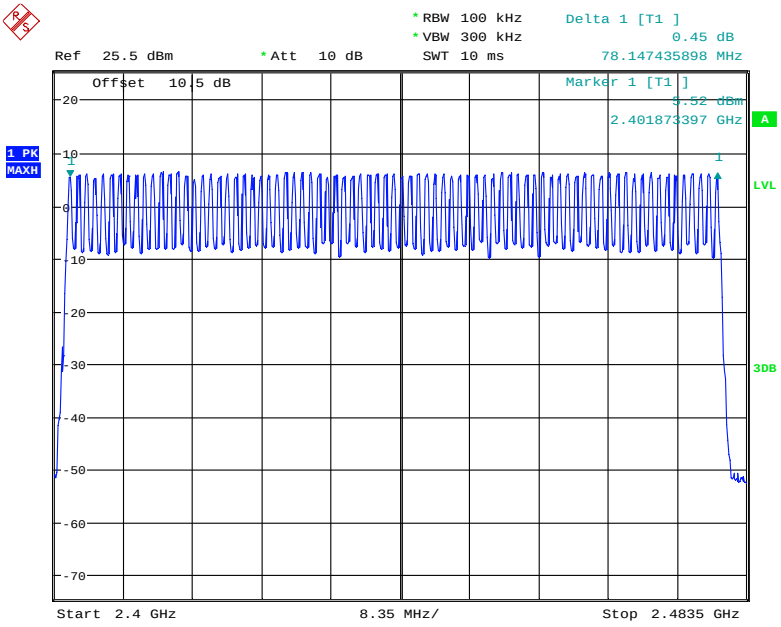
The testing was performed by Shawn Xiao on 2018-09-13.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following table and plots.

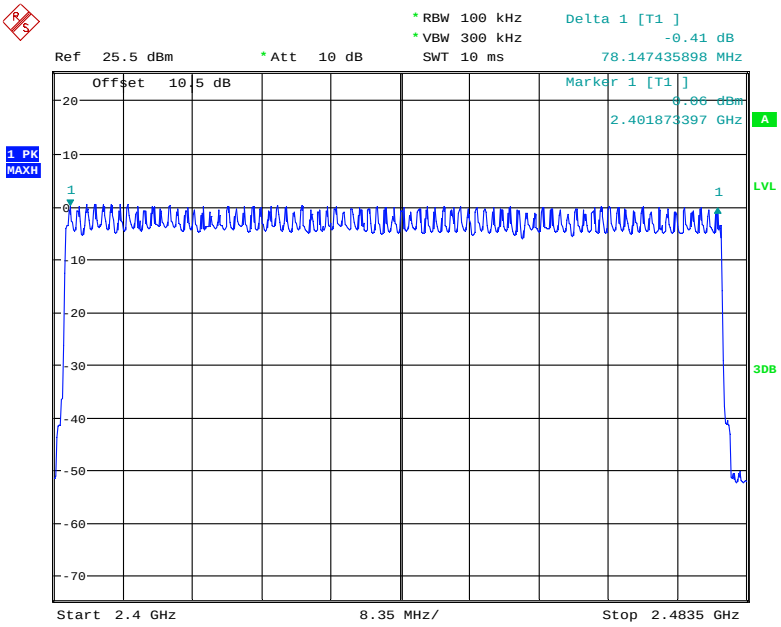
Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥15
EDR (π/4-DQPSK)	2400-2483.5	79	≥15
EDR (8-DPSK)	2400-2483.5	79	≥15

BDR (GFSK): Number of Hopping Channels



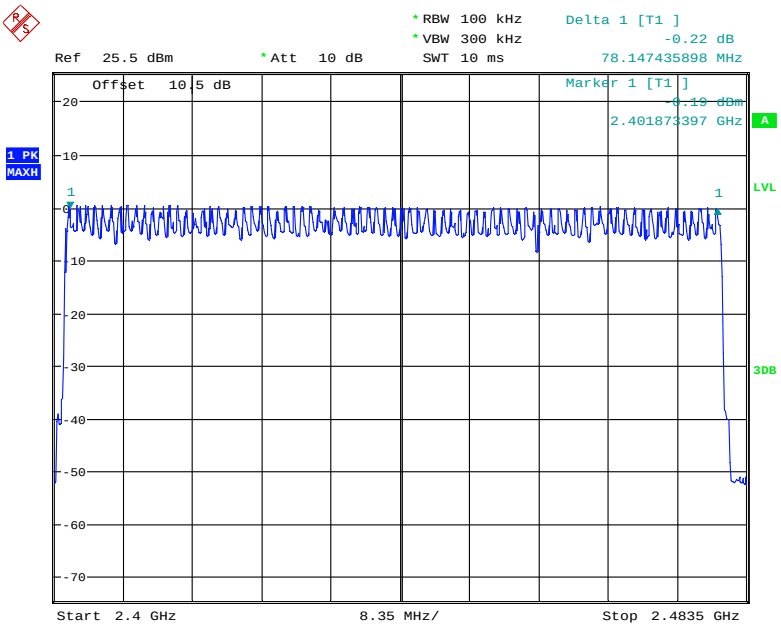
Date: 13.SEP.2018 22:39:09

EDR (π/4-DQPSK): Number of Hopping Channels



Date: 13.SEP.2018 22:42:33

EDR (8-DPSK): Number of Hopping Channels



Date: 13.SEP.2018 22:45:15

FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
a) Span: Zero span, centered on a hopping channel.
b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d) Detector function: Peak.
e) Trace: Max hold.
Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test or each variation in transmit time.
Repeat the measurement using a longer sweep time to determine the number of hops over the period pecified in the requirements. The sweep time shall be equal to, or less than, the period specified in the equirements. Determine the number of hops over the sweep time and calculate the total number of hops in he period specified in the requirements, using the following equation:
(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)
The average time of occupancy is calculated from the transmit time per hop multiplied by the number of ops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.
The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Shawn Xiao on 2018-09-13.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following table and plots

Mode		Pulse Time (ms)	Hopping Number	Period Time (s)	Total of Dwell (ms)	Limit (ms)	Result
BDR (GFSK)	DH 1	0.428	310	31.6	0.133	400	Pass
	DH 3	1.707	190	31.6	0.324	400	Pass
	DH 5	2.957	120	31.6	0.355	400	Pass
EDR (π/4-DQPSK)	2DH 1	0.436	320	31.6	0.140	400	Pass
	2DH 3	1.697	170	31.6	0.288	400	Pass
	2DH 5	2.965	120	31.6	0.356	400	Pass
EDR (8-DPSK)	3DH 1	0.439	320	31.6	0.140	400	Pass
	3DH 3	1.697	120	31.6	0.204	400	Pass
	3DH 5	2.973	110	31.6	0.327	400	Pass

Note 1: (Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) * (period specified in the requirements / analyzer sweep time)

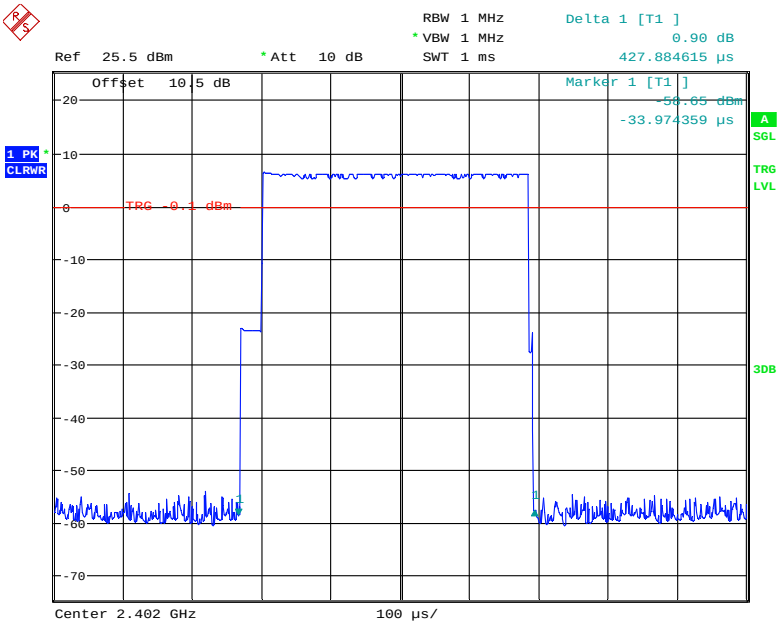
Thus, A period time = 0.4*79=31.6(s), Total of Dwell=Pluse Time*Hopping Number

Note 2: Hopping Number (3.16s) = Total of highest signals in 3.16s.(Second high signals were other channel)

Note 3: Hopping Number= Hopping Number (3.16s) *10

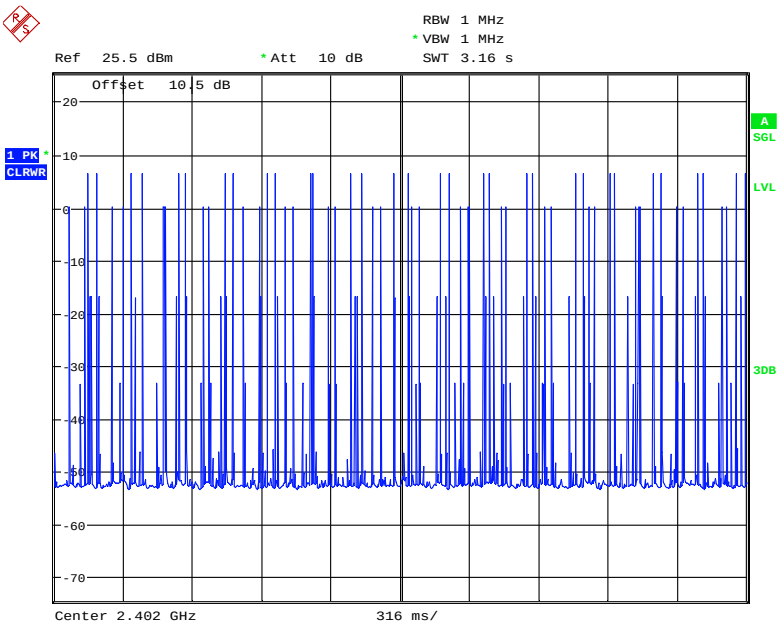
BDR (GFSK):

Pulse time, DH1



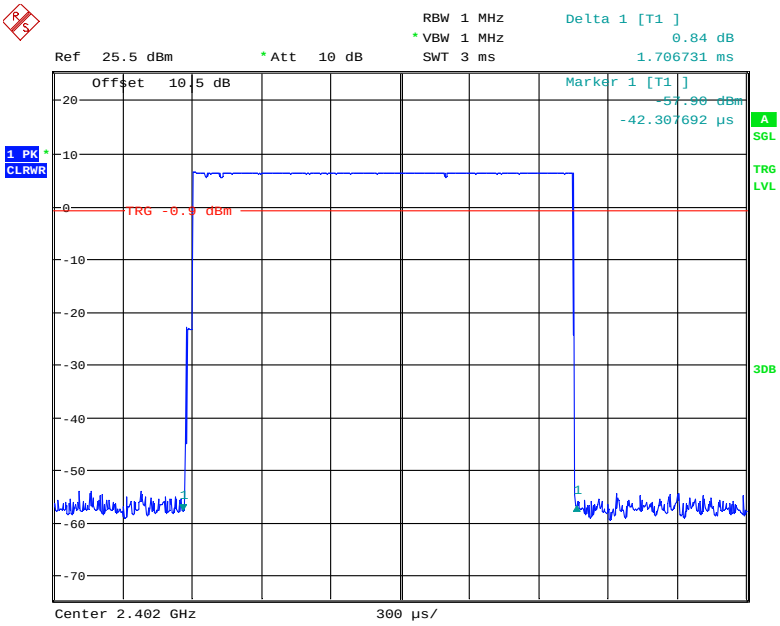
Date: 13.SEP.2018 22:47:52

Hopping number in 3.16S, DH1



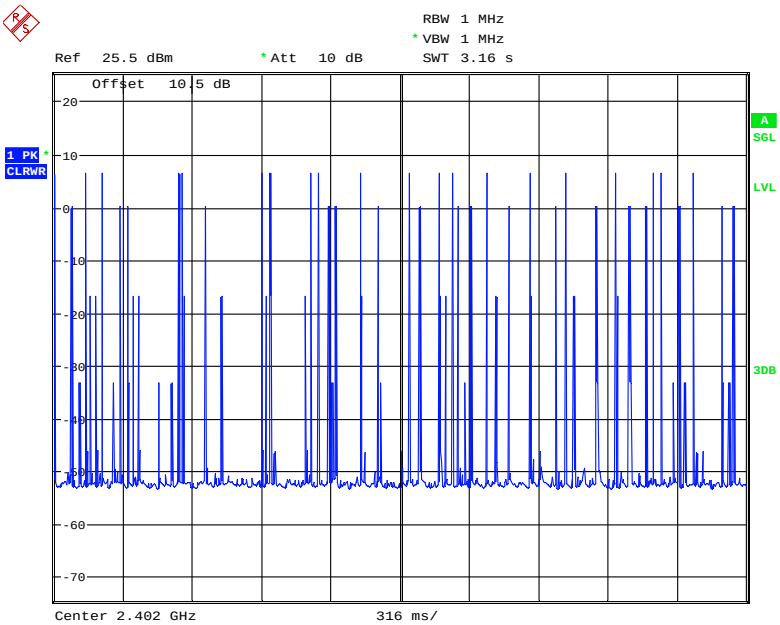
Date: 13.SEP.2018 22:51:11

Pulse time, DH3



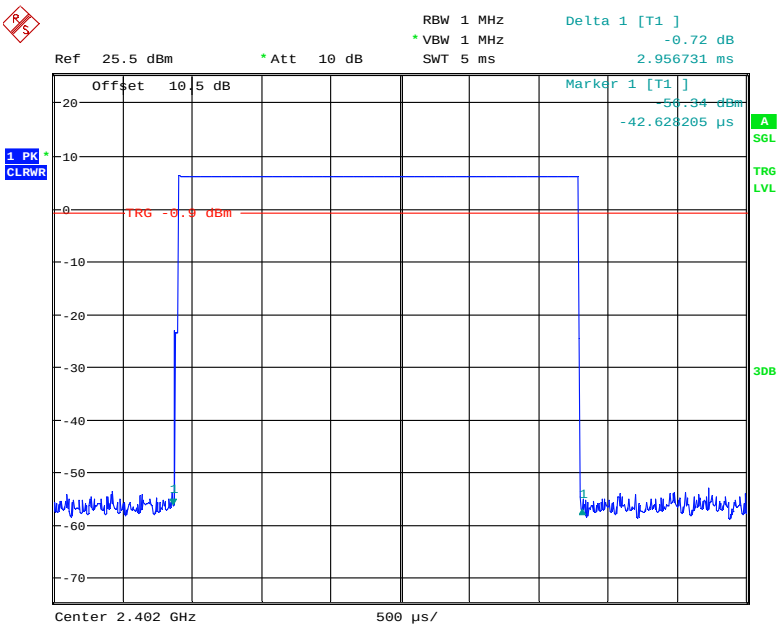
Date: 13.SEP.2018 23:00:31

Hopping number in 3.16S, DH3



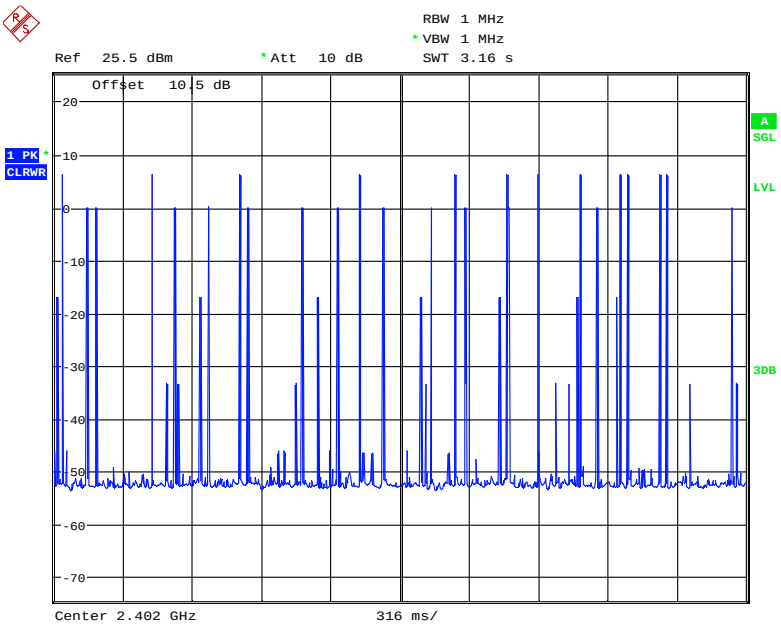
Date: 13.SEP.2018 23:01:43

Pulse time, DH5



Date: 13.SEP.2018 23:07:13

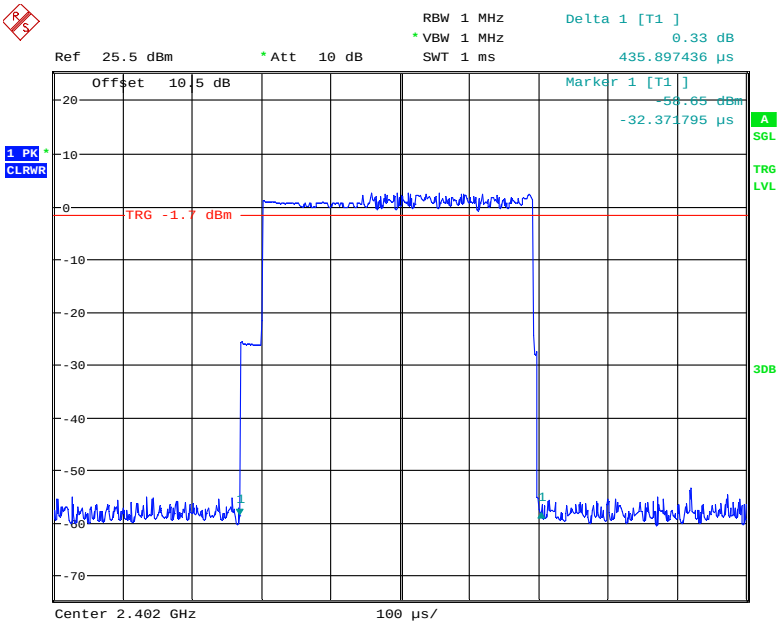
Hopping number in 3.16S, DH5



Date: 13.SEP.2018 23:09:15

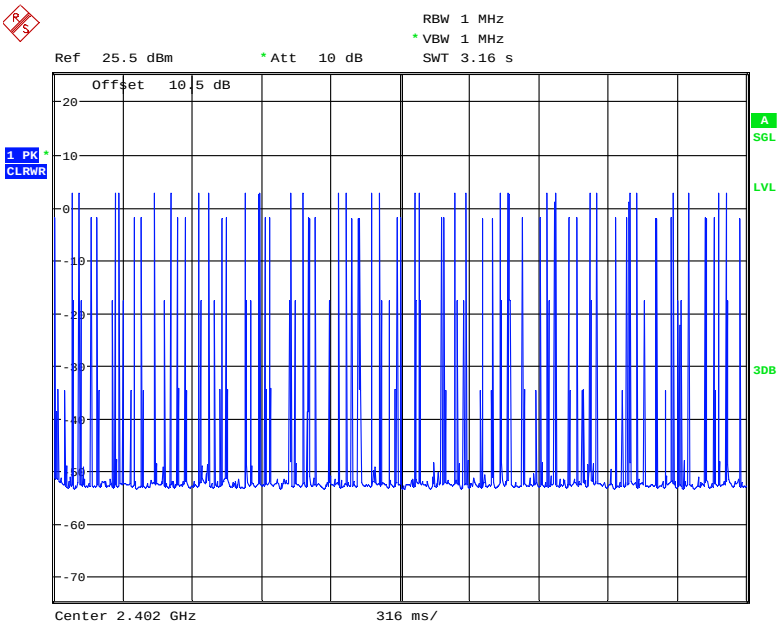
EDR (π/4-DQPSK):

Pulse time, 2DH1



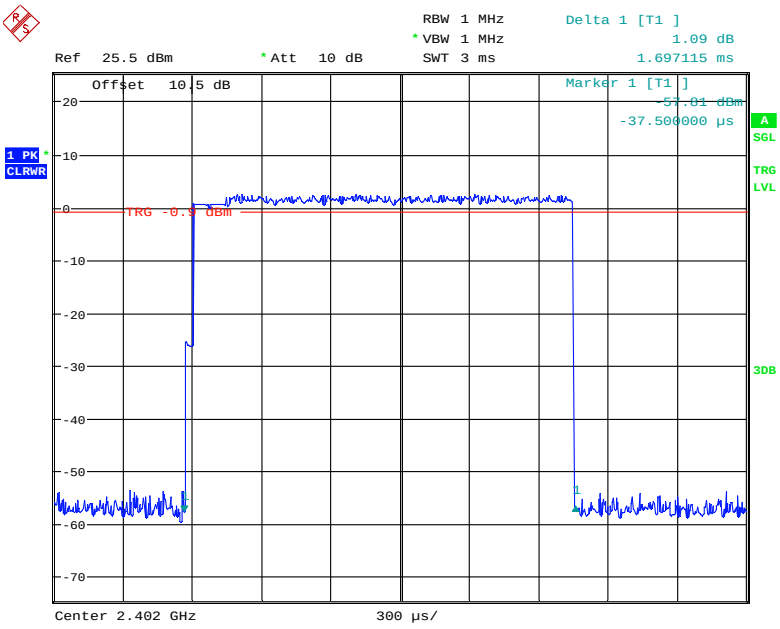
Date: 13.SEP.2018 22:53:22

Hopping number in 3.16S, 2DH1



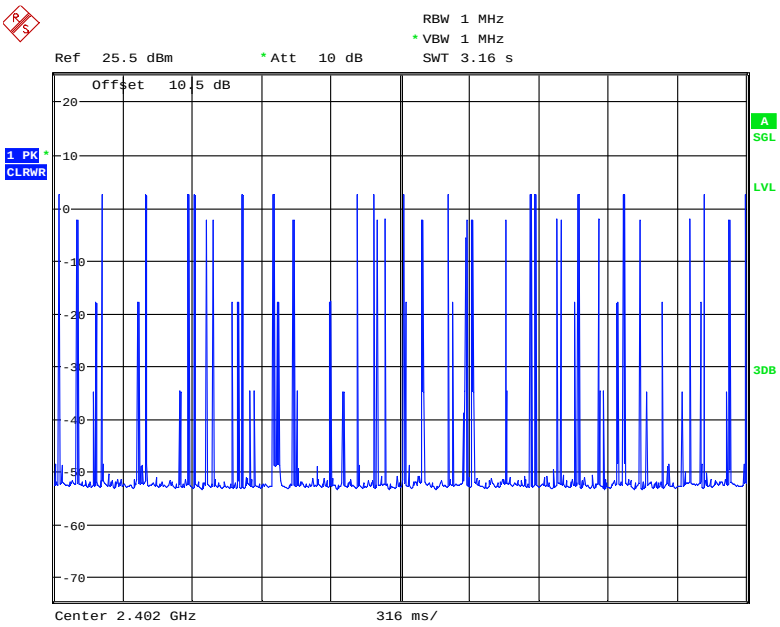
Date: 13.SEP.2018 22:56:45

Pulse time, 2DH3



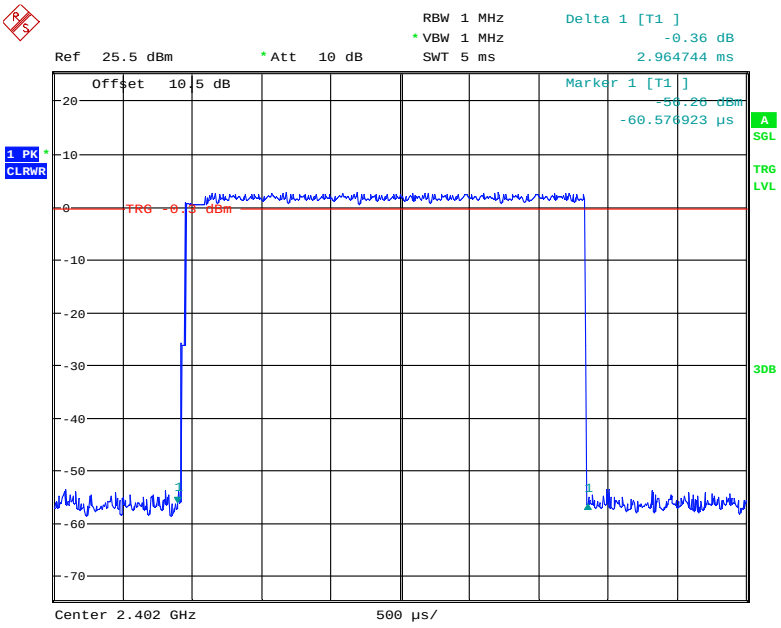
Date: 13.SEP.2018 23:02:35

Hopping number in 3.16S, 2DH3



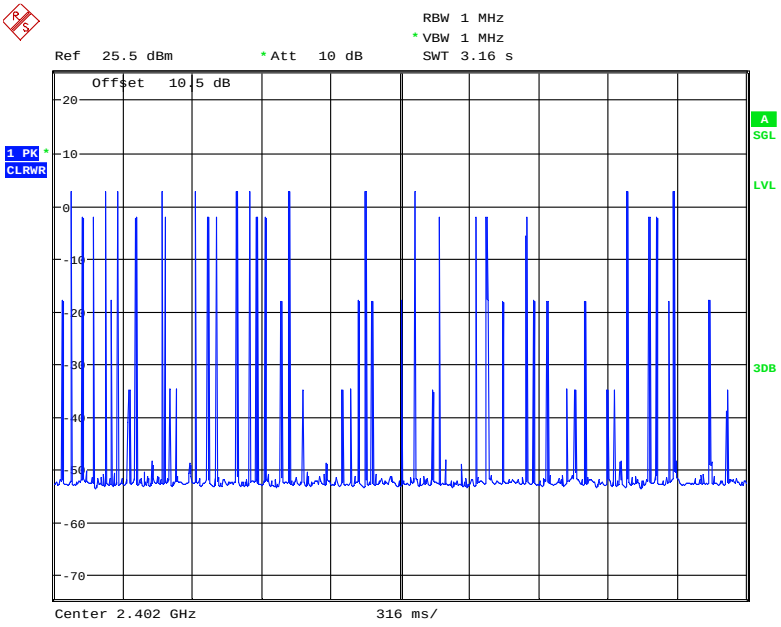
Date: 13.SEP.2018 23:03:52

Pulse time, 2DH5



Date: 13.SEP.2018 23:32:39

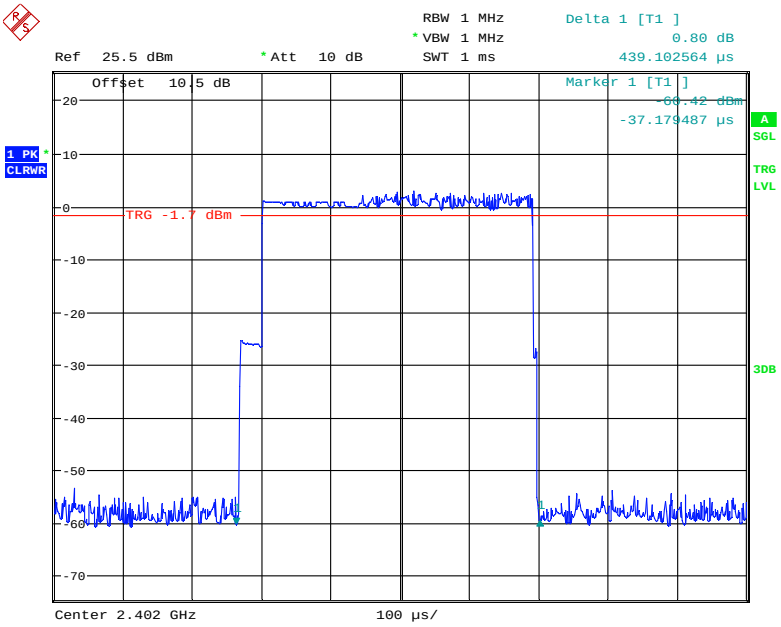
Hopping number in 3.16S, 2DH5



Date: 13.SEP.2018 23:34:03

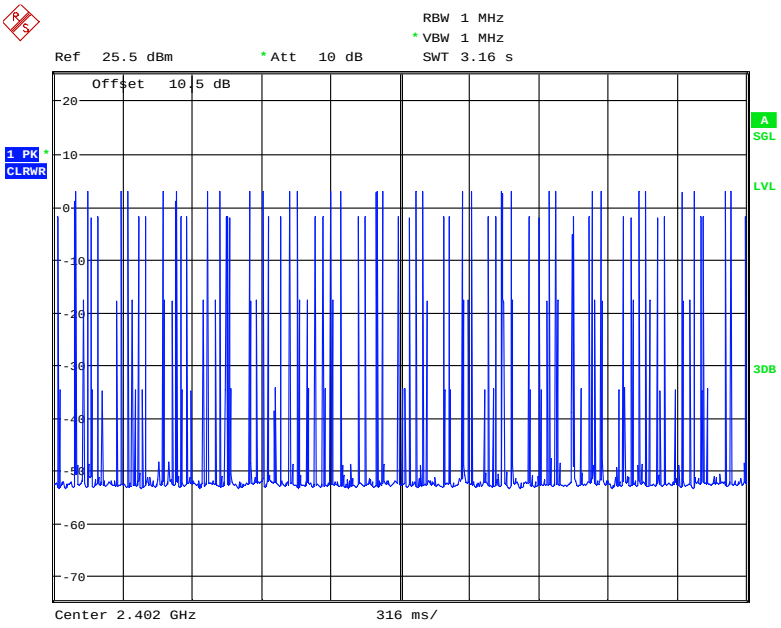
EDR (8-DPSK):

Pulse time, 3DH1



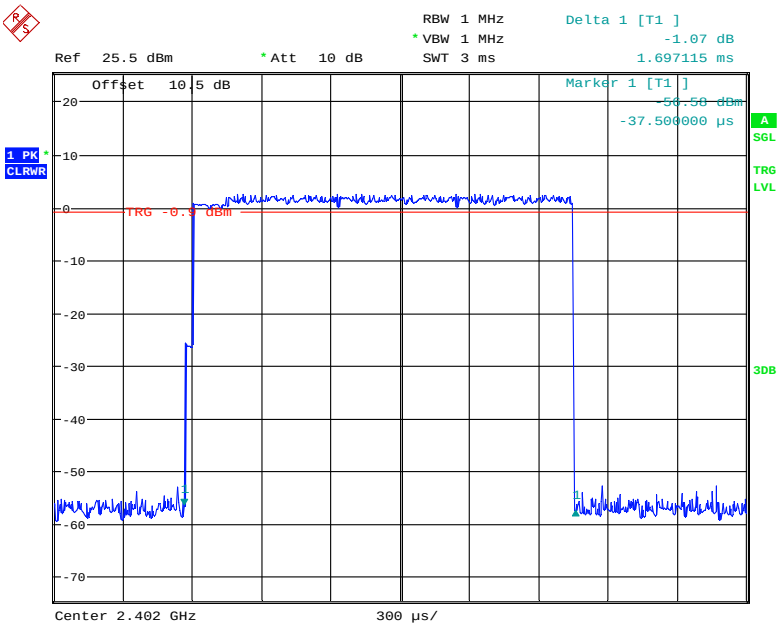
Date: 13.SEP.2018 22:57:34

Hopping number in 3.16S, 3DH1



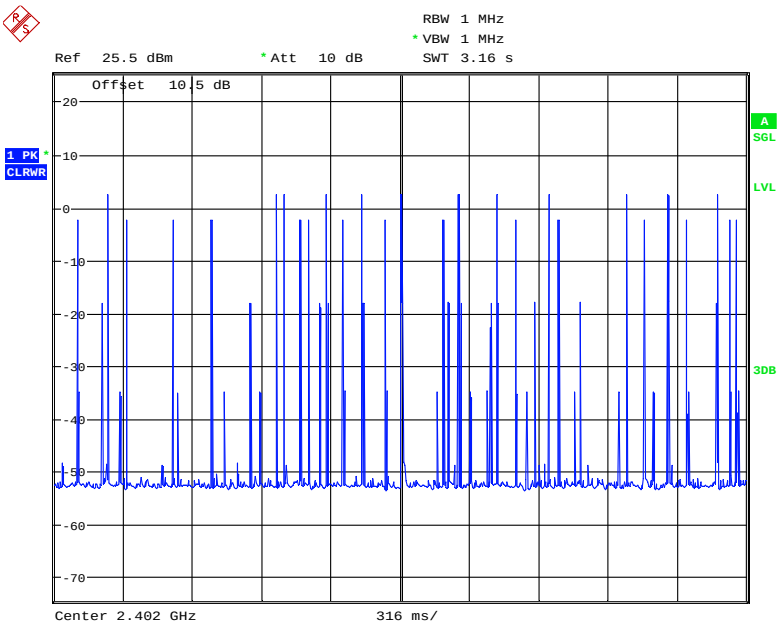
Date: 13.SEP.2018 22:59:15

Pulse time, 3DH3



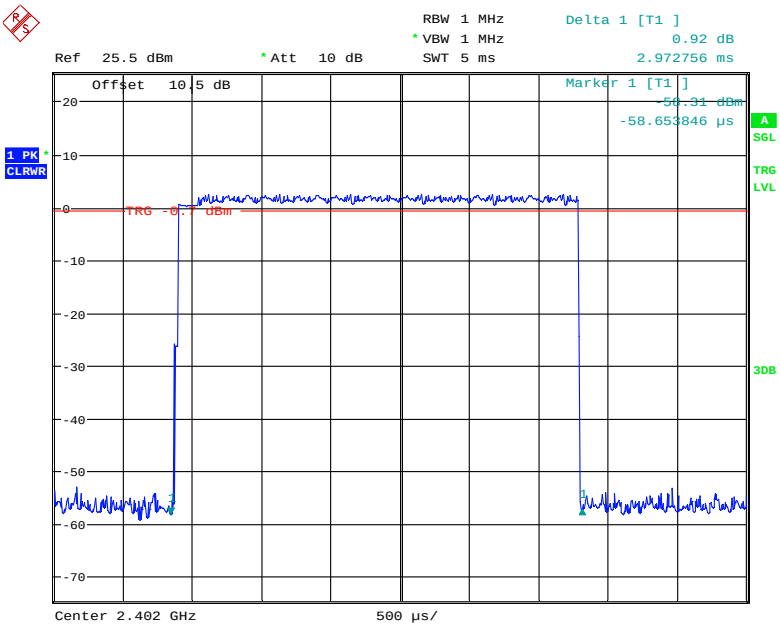
Date: 13.SEP.2018 23:04:39

Hopping number in 3.16S, 3DH3



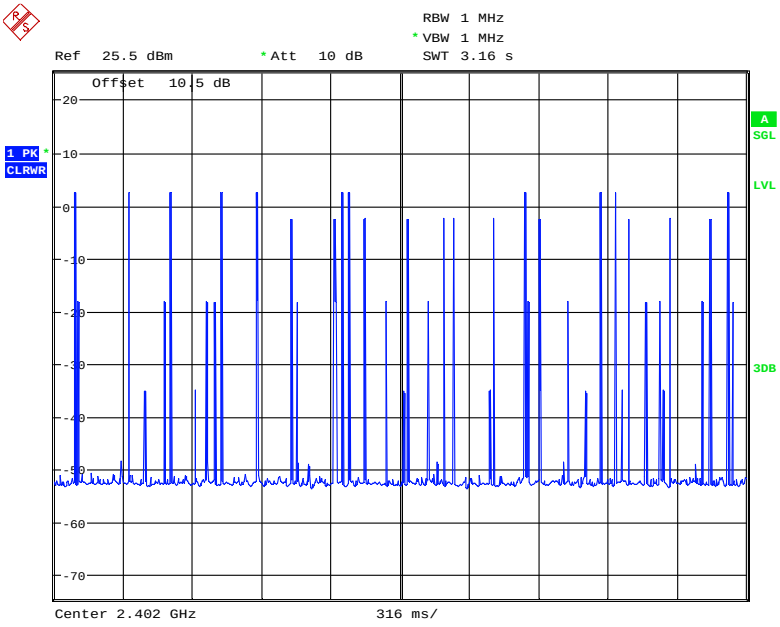
Date: 13.SEP.2018 23:06:17

Pulse time, 3DH5



Date: 13.SEP.2018 23:11:10

Hopping number in 3.16S, 3DH5



Date: 13.SEP.2018 23:17:48

FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Shawn Xiao on 2018-09-13.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following table.

Mode	Channel	Frequency (MHz)	Peak Output Power		Limit (mW)
			(dBm)	(mW)	
BDR (GFSK)	Low	2402	6.73	4.71	125
	Middle	2441	6.82	4.81	125
	High	2480	6.74	4.72	125
EDR (π/4-DQPSK)	Low	2402	2.79	1.90	125
	Middle	2441	2.42	1.75	125
	High	2480	2.17	1.65	125
EDR (8-DPSK)	Low	2402	3.31	2.14	125
	Middle	2441	2.95	1.97	125
	High	2480	2.66	1.85	125

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

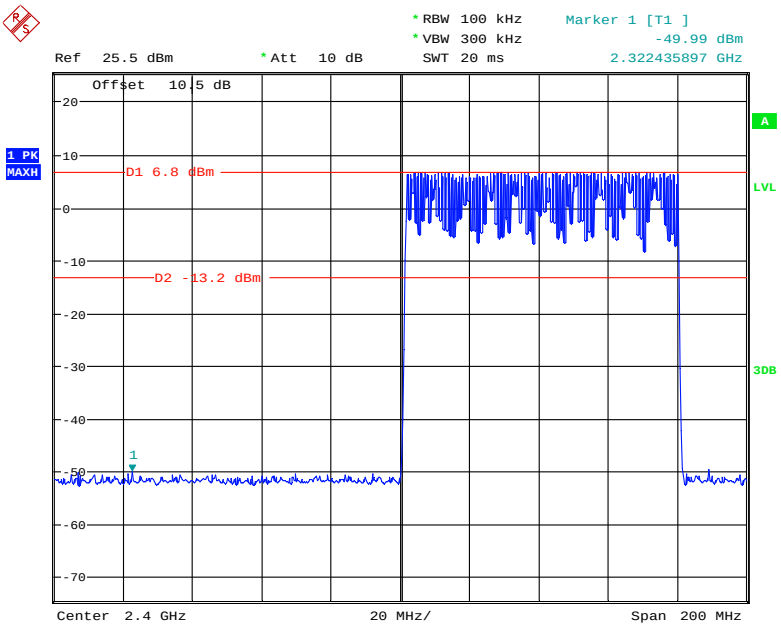
Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Shawn Xiao on 2018-09-13.

EUT operation mode: Transmitting

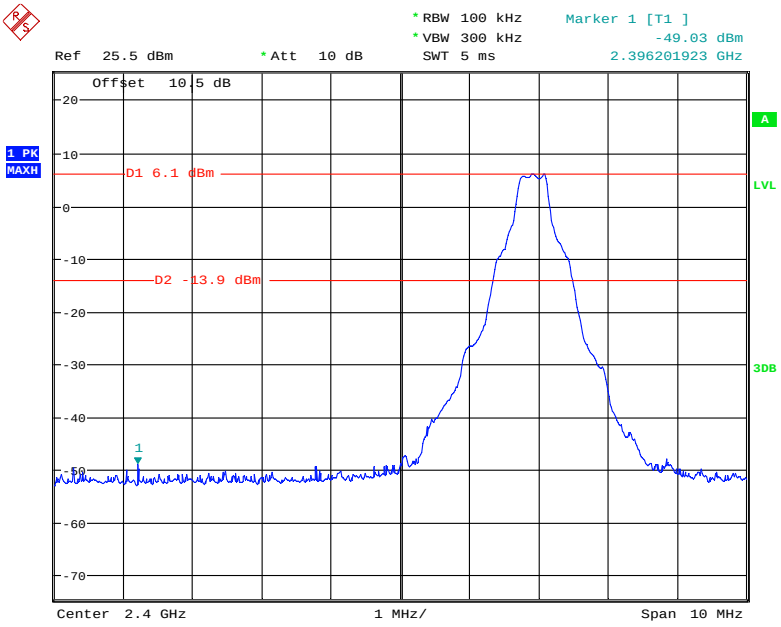
Test Result: Compliance. Please refer to following plots.

BDR (GFSK): Band Edge-Left Side Hopping



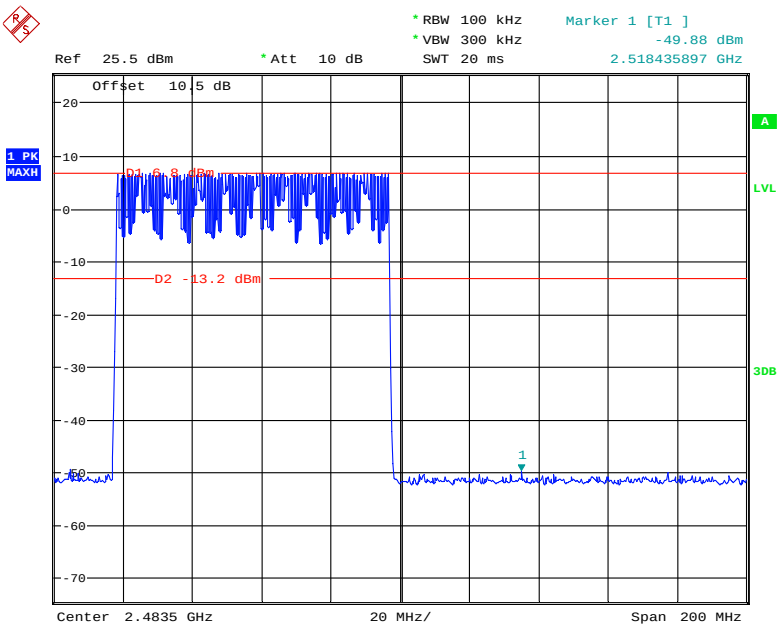
Date: 13.SEP.2018 22:18:07

Single



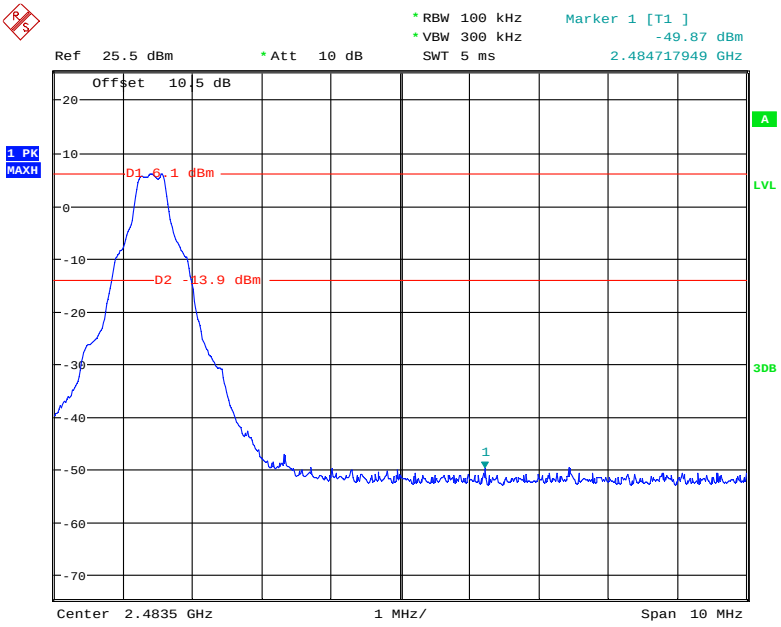
Date: 13.SEP.2018 22:20:41

BDR (GFSK): Band Edge-Right Side Hopping



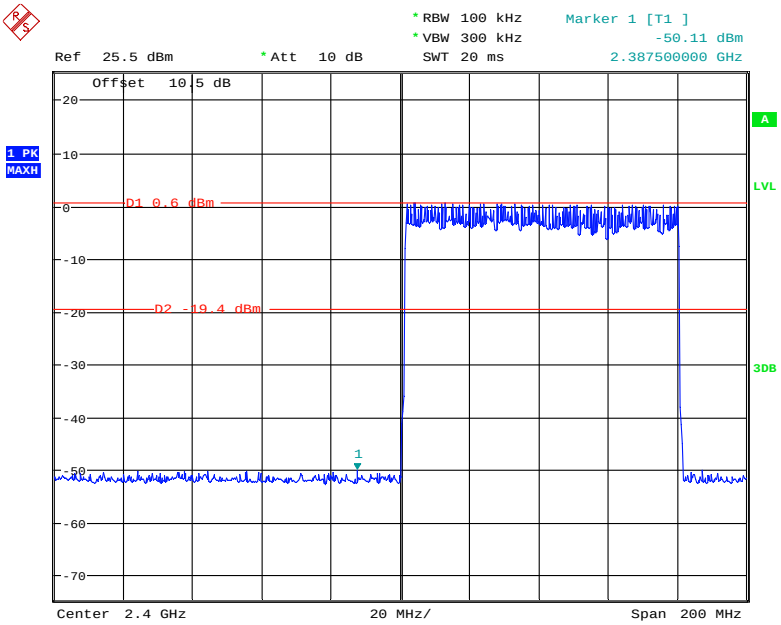
Date: 13.SEP.2018 22:15:44

Single



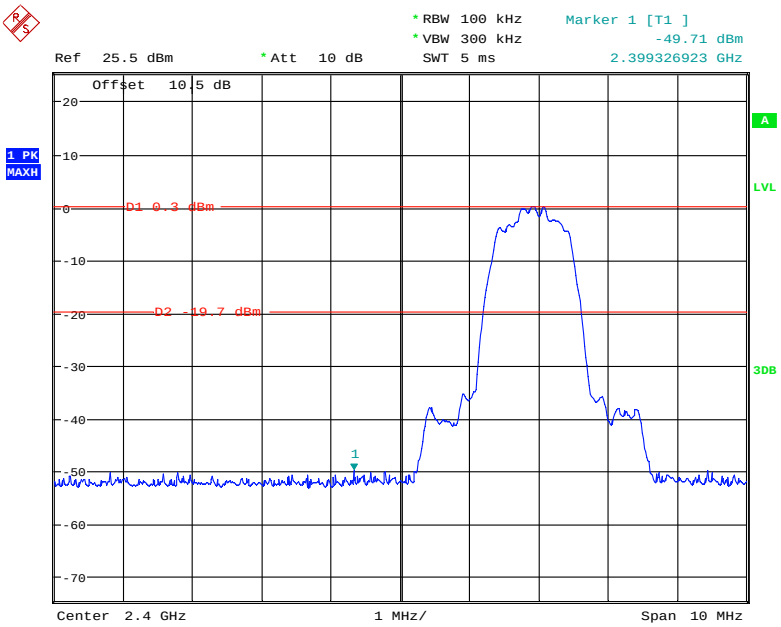
Date: 13.SEP.2018 22:22:51

EDR (π/4-DQPSK): Band Edge-Left Side Hopping



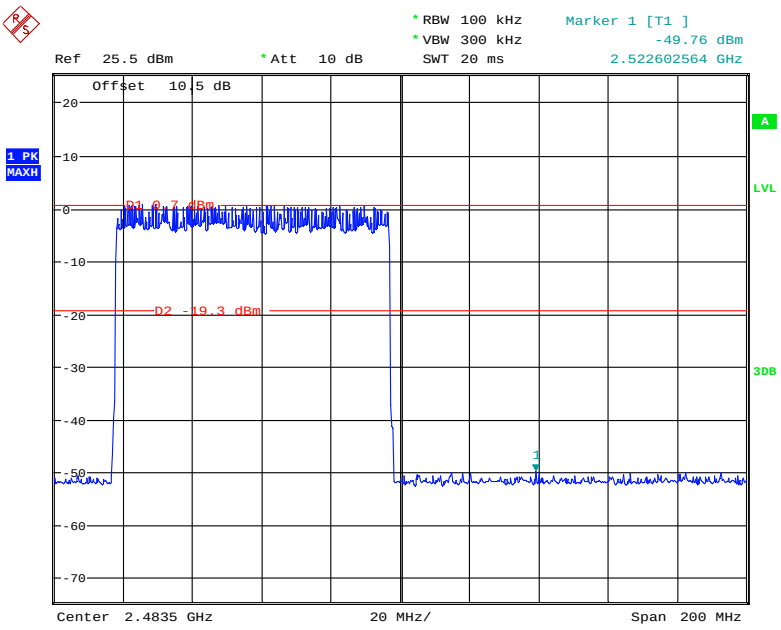
Date: 13.SEP.2018 22:09:41

Single



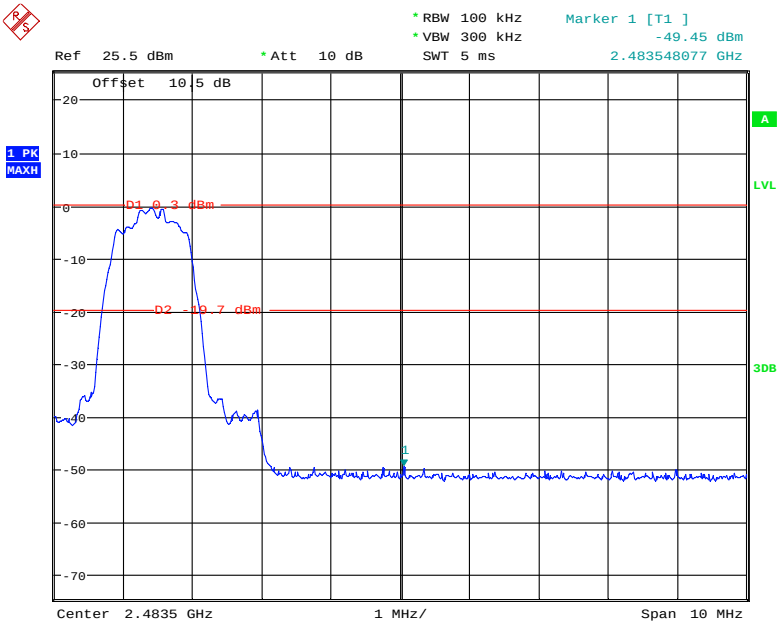
Date: 13.SEP.2018 22:25:11

EDR (π/4-DQPSK): Band Edge-Right Side Hopping



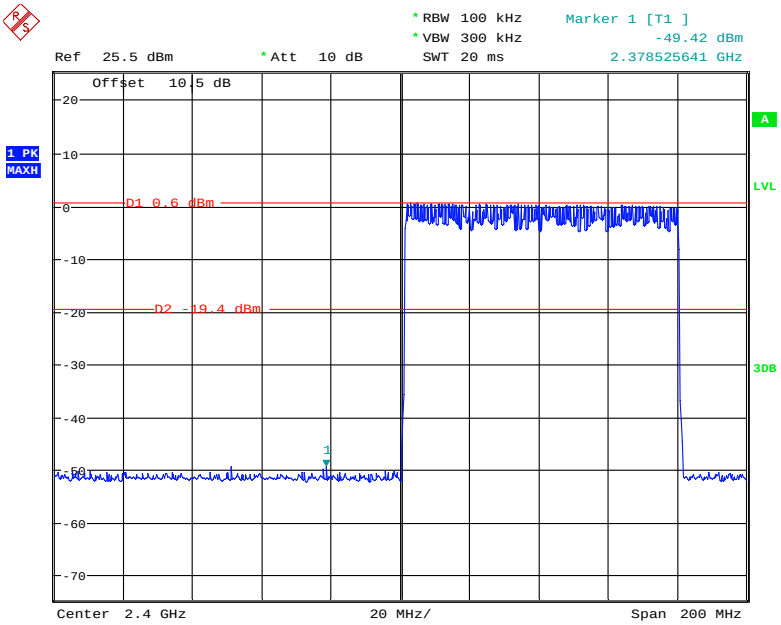
Date: 13.SEP.2018 22:12:12

Single



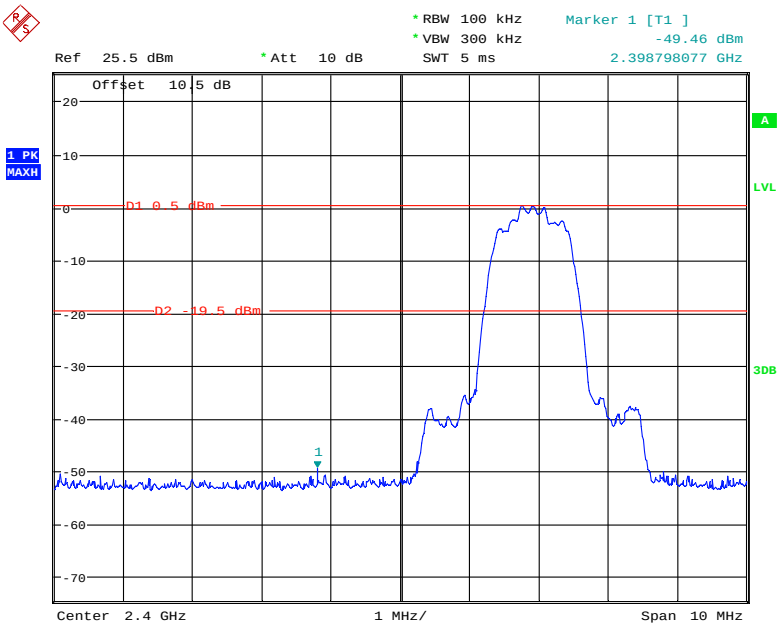
Date: 13.SEP.2018 22:33:32

EDR (8-DPSK): Band Edge-Left Side
Hopping



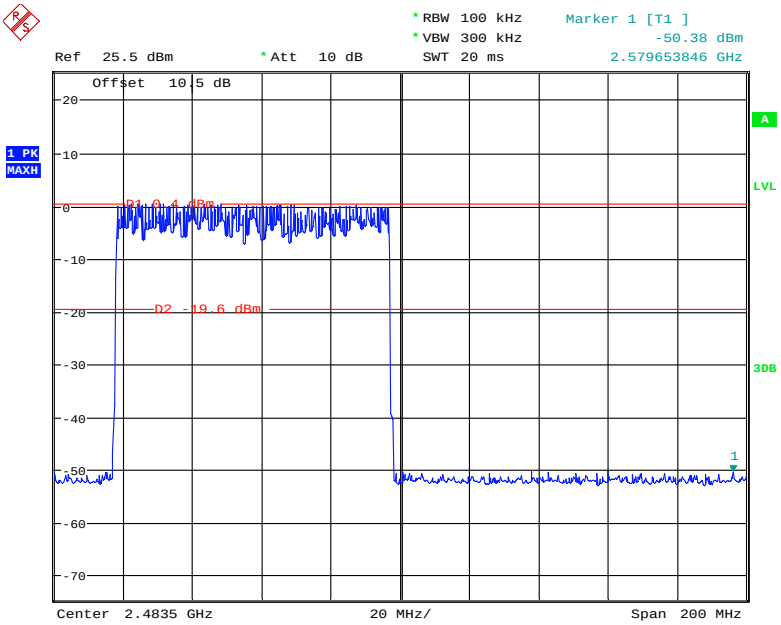
Date: 13.SEP.2018 22:07:10

Single



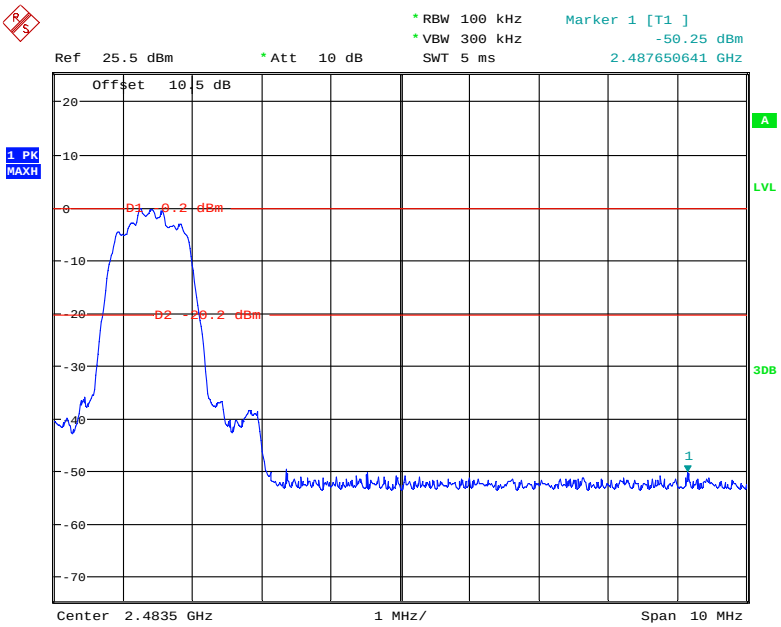
Date: 13.SEP.2018 22:34:38

EDR (8-DPSK): Band Edge-Right Side Hopping



Date: 13.SEP.2018 22:02:10

Single



Date: 13.SEP.2018 22:35:34

******* END OF REPORT *******